GAZETTEER OF INDIA

KERALA STATE GAZETTEER

VOL. I

GOVERNMENT OF KERALA

GAZETTEER OF INDIA

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VOL. I

By

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INTRODUCTION

The First Volume of the State Gazetteer of Kerala is now being released. The Volume is conceived and devised in such a manner as to serve as an invaluable and veritable mine of authentic information covering various aspects of life in the State and will no doubt be of great reference value to its users.

The Gazetteer by its nature provides all with the knowledge of the rich heritage of Kerala. It has an important role in educating public opinion and thus strengthening the foundations of our national life.

The present Volume deals with the origin of the name of State and its evolution as an administrative unit, geography, geology, flora, fauna and climatology of Kerala.

The Kerala Gazetteers Department which has attempted this stupendous task deserves commendation. Shri Adoor K. K. Ramachandran Nair, the State Editor has done an appreciable work in presenting the Volume to the public.

It is hoped that this Volume will be a fresh source of inspiration to the study of Kerala.

Trivandrum T. M. JACOB

PREFACE

The Kerala Gazetteers Department has so far published ten District Gazetteers under the Scheme of preparing the District Gazetteers taken up as a national project by Government of India in 1957. The printing of the Malappuram District Gazetteer, the tenth and last in the series of the District Gazetteers of Kerala is in its final phase and slated for publication. The Government of India in 1976 took up the programme of issuing supplements to the District Gazetteers which were prepared and published upto the year 1966, to update the data contained in the concerned District Gazetteers. Adhering to this the Supplements to the District Gazetteers of Trivandrum, Quilon, Trichur, Kozhikode and Ernakulam were published by me after my appointment as State Editor, in December 1979. In addition, the Department has republished the monumental work on the History of Travancore by Shri P. Shangoonny Menon.

The preparation of the State Gazetteer Volume-I was initiated in March of 1984 and the manuscript sent for printing in December 1984. It is for the first time that such an ambitious venture is taken up in Kerala.

Located at the southern extremity of the Indian subcontinent, the State of Kerala is resplendent for its scenic splendour as well as its eminent contribution to the country's intellectual and cultural landscape. It is a land where nature still holds her own in spite of industrialisation,urban influx and high population, where the literacy rate is the highest in the country, where people of diverse fashions and political beliefs have been able to forge a common ethos and find a common identity. Foremost among the advantages that Kerala enjoys is the abundance of educated and skilled man-power that has made its presence felt in other parts of the country as well as abroad.

The total area of the State is 38,855 square kilometres and a coast line nearly 550 kms. long. It is a narrow strip of green stretch along the coast, for the width nowhere is over 100 kms.

and narrows in the south to 12 kms., the average being 70 kms. The land may be broadly divided into 3 natural divisions, lowland, midland and highland. Few lands of similar extent are watered by so many rivers. They rise from the Western Ghats and the landscape of their banks changes from jutting tops, crowned by thick forests in the east, to groves in the midland and groves and fields in the lowland. There are 41 west-flowing rivers in the State in addition to three east-flowing ones which are tributaries of the Kaveri. The longest river is the Periyar (244 kms.). The rivers are rich in association regarding Kerala traditions. Kaladi on the banks of the Periyar was the birth place of the Great Sankara. Pan-Kerala Assemblies called *Mamamkam* of great pomp and circumstance were held at Tirunavai under the Zamorin of Calicut till the latter half of the 18th century. To-day many rivers have been harnessed for irrigation and power and are making a great contribution to the economic progress of the land. In addition Kerala has a continuous chain of lagoons and backwaters. The backwaters, rivers and the canal system form a navigable inland waterway of about 1960 kms. which is more than one fifth of the total length of India's inland waterways.

The sea which gave birth to Kerala also helped in moulding her history. The maritime tradition of the State can be traced to the hoary days of antiquity. Peaceful interaction with farflung lands through trade had built up a tradition of more than two millennia before the incursions from modern Europe symbolised by the landing of Vasco Da Gama at Calicut in 1498, changed the temper of the contact., loaded it with conflicts and inflicted a turbulent phase of history which ended only with Independence.

Richness of soil, heavy rainfall and damp climate have given rise to a flora & fauna of great variety. The forests abound in timber and flower tracts, in elephants, black leopards, tigers, sloth bear, giant squirrels, bison, a variety of deer, the charming little honey sucker with glorious metallic colours, the golden beaked wood pecker, the little white-eyed tit and the Malabar whistling thrush.

With 25.40 million people (1981 census) living in a small state, with an area of 39,000 square kilometres, Kerala has a high density of population; 654 persons per square kilometre, the all India average being 216. The tourist who travels either by rail or road will get the impression that the entire land has been urbanised for houses march along both sides of the track without the open spaces that separate villages in the north giving the impression of a continuous conurbation.

Urbanisation however has not resulted in any monotony and bigger cities and towns have their own attractive individual features. Trivandrum, the capital stands on a hillock sloping down to the sea and therefore washed clean during the rains With its dense greenery broken by the gabled house tops, its undulating roads, groves and parks, it is a very picturesque city. It is also an extraordinarily clean township. The other important centres are Quilon, Cochin, Trichur and Calicut, each with its distinct historical tradition.

The State is not known to have any resources of oil or coal. The absence of basic minerals like coal, iron and copper is a serious impediment to industrial development. The beach sands however are a good source of titanium bearing ilmenite. Fortunatelythe State has immense potentiality for the generation of hydro-electric power and if properly developed this can compensate for the absence of fossil fuels. The distinctive characteristics of the agricultural sector in Kerala deserve special emphasis. The high pressure of population on land has rendered a large part of the rural population traditionally dependent on agriculture either unemployed or employed. The cultivation of cash crops is better organized in Kerala than elsewhere in the country. In Kerala only about 56% of the total area of the State is availablefor cultivation, the rest being forests and uncultivable lands. In the country as a whole about 70% of the cropped area is under food grains, but in Kerala only about 30% is under foodgrains. On the other hand, more than 50% of the cultivable area is under commercial crops like tea, rubber, coconut, cardamom etc. This cropping pattern has its own advantages and disadvantages. It earns valuable foreign exchange for the country by the export of commercial crops. It also creates a

huge deficit in food grains which sustains the population. Only about 55% of Kerala's rice requirements is produced within. For the balance, it has to depend on supplies from outside.

The basic problem of Kerala is its high density of population which is more than three times the all India average. The larger the population, the smaller will be the income per capita, the smaller will be the ability of the community to save and invest in developmental activities. A further dampening effect on the tempo of development is the increase in expenditure on education, health and housing demanded by steadily growing population. The greater the proportion of the people in the younger age groups in the population, the larger will be the expenditure on such items as education and health. Unemployment especially among the educated is of an alarming proposition, the number of work seekers sharply increasing year by year. The work seekers as a proportion of the all India work seekers is more than 10%. The proportion of educated work seekers (S. S. L. C. and above) is over 50% of the total number of work seekers. In the context of the large excess of working force, modernization of the existing sectors, perhaps the only means of improving production is beset with conflict interest and confusion. There is an all round awareness of the basic problems and a will to overcome these handicaps.

The vast majority of the population speak Malayalam. The other languages spoken are Tamil, Kanarese, Konkani, Gujarathi, Marathi, Arabic, Hebrew etc.

Much attention has been paid in recent years to provide effective and well planned services to the rural areas in different fields like education, medical aid, water supply, electrification, housing, public distribution, communications, public transport etc. Thus the rural population does not have to migrate to towns in search of these facilities. Such a fairly evenly spread infrastructure development has evidently prevented the over crowding of cities and towns. Fortunately the cities of Kerala are free of the sores which inevitably characterise other metropolises.

The population of the State is composed of a variety of religions. The traditional religious toleration and amity have been, responsible for the existence of a number of flourishing communities from very ancient times. There are Hindus, Muslims, Christians, Tribal castes, Jews, Jains, Buddhists Parsees and Sikhs according to Census enumeration. The Hindu community covers a large number of sub communities like Brahmins, Kshatriyas, Ambalavasis, Ezhavas, Nadars and Scheduled castes. The Brahmins include Malayali or Namboodiri Brahmins, Tamil Brahmins. Tulu Brahmins, Gauda Saraswats etc. There are a number of Sub-Castes among Kshatriyas, Ambalavasis and Scheduled Castes. The Christians include Roman Catholics (Syrian & Latin) Jacobite Syrians, Marthoma Syrians, Chaldean Syrians, Salvationists, Anglican Communionists, members of the United church, and members of the various Missionary bodies like the Protestant Mission, S. D. A. Nadar Christian, Brother Mission, Penteocost, P. R. D. S. Bible faith, Baptist etc. The Muslims are divided into Shias and Sunnies.

By appearance, dress and habits, the people of Kerala can be broadly divided into two classe. The descendants of those who came under the civilising influence of the Aryan immigrants who occupied from early times, positions of distinction and authority are to be distingushed from the descendants of those who stood outside their fold. The distinctiveness in personal appearance marked by fairness of complexion and regularity of features, clean habits and simple life can be attributed to the social rank which they enjoyed irrespective of their religious persuasions. The indigenous population herein has been an admixture of foreign blood characterised by dark complexion and features which are not distinctly pronounced. Even among the apparently homogenous group certain distinguishing features exist to identify the peculiar sect or class to which each belonged. Thus the tuft with its varying modes of tying differing from sub sect to sub sect and identifying caste marks on the forehead associated with Hindus, the close shave of the Christians, the skull cap or the turban of the Muslims have been in vogue for a long time. The Malayali women were noted for their preference of simple white dress though the manner of dressing

varies with women of the various communities. The Nayar ladies had the *Pudava*, rouka and upper cloth, all white in colour and the Christian ladies their cloth worn in a distinctive style with a fanlike portion on the back side and long sleaved blouse. The Muslim women also have their distinctive dress. The women of this sect used to wear heavy ornaments particularly ear pendents, some of them used to bedeck their head, ears, nose, neck and arms, the waist and ankles with heavy jewellery. But there has been in the last few decades rapid changes in these directions. The outlook on life in general has changed considerably and new ideas resulting in from liberal education has permeated society at large. The tuft is no longer an identifying mark of a Hindu. The wearing of castemarks has become a rarity. The close shave of the Christian has disappeared. There is a tendency to give up the skull cap and the turban among some of the Muslims also. Among the Nayar ladies, the *Pudava* and *Rauka* have mostly given place to the saree and the blouse. Among the Christain ladies, the younger generation has taken to sarees and those who used traditional costumes have considerably modernised them. The tendency among the younger generation of women is to limit the ornaments to a gold chain with a pendent of artistic workmanship a pair of ear rings and several bangles of different patterns. Blackening of the eyes and eye brows with antimony was a common practice among Hindu women. The Muslim women used Surma. Both certainly added to their comeliness. The practice still continues but is now done more artistically. The Nambudiri women observed the *Purda* system which no longer finds favour with them.

Of the customs peculiar to Kerala, the most importnt ones are the *Marumakkathayam* system and the joint family system. The *Marumakkathayam* system determines inheritance through the female line. The Kshatriyas, the Ambalavasi, the Samanthars, the Nayars, some of the Ezhavas, the Nanjinad Vellalas and some Muslims followed this system. The joint family system where the members live under the same roof without partition and the eldest male member of the family who is called *Karnavan* exercises full powers over the affairs of the family is also peculiar to Kerala. Among the *Marumakkathayees*, it was the

custom that the wife and children of a male member of a joint family used to reside in the joint family of which his wife is a member. As a result of intense social pressure, legislative enactments sanctioned the claim to partition from the joint family and adopt *Makkathayam*—Inheritance through male line. Due advantage has been taken of these legislations by the majority of the communities and the gradual but steady break up of the joint family system resulting in individual members leaving their joint family and setting up homes of their own has been a salient feature in the recent past. But legislation has not extirpated the *Marumakkathayam* customs and traditions. The divided members still cling on to their old family names and titles. In the observance of the customary ceremonies and pollutions the affinity of the *Marumakkathayam* system is still evident.

Child marriage once in vogue among several communities has been prohibited. Inter marriages between sub-castes have become more common even among orthodox circles. Marriage ceremonies usually of several days duration has been reduced to an almost one day function. Marriage without dowry has become an exception even among communities which observed the dowry system—thanks to Anti Dowry legislation. Although in former times the caste system had considerably affected social intercourse, conditions have become entirely different now. In respect of social functions like garden parties and at homes there is no communal segregation with the abolition of untouchability and legislation hrowing open temples to all classes of Hindus, people have shaken themselves off most of the tentacles of caste which separated one sect from another.

It has to be emphasised that the observance of caste system with all its rigour and formalities was another social peculiarity of Kerala. Though the system prevailed throughout India, no other place was marked by its stringent enforcement than Kerala, that the Great Hindu Seer & Sage Swamy Vivekananda referred to Kerala as the 'mad house of India'. Persons belonging to non-caste—Hindus called the *Avarnas*, were not allowed to enter and worship in Hindu temples, were prohibited from walking on the approaches to temples, and were not allowed to

mix with caste Hindus called Savarnas in educational and other public institutions. Both sight and touch pollution were in vogue with stiff penalties for any breach in observance of tradition. Instances of denial of job opportunity in Government departments to educated entrants from among the avarnas on the basis of birth, were innumerable. Consequent on the powerful movement for social reform and abolition of caste system launched by the great Saint Sree Narayana Guru, the observance of untouchability has become a thing of the past. This was accentuated by the Temple Entry Proclamation in 1936, by the Maharaja of Travancore backed up by legislations for temple entry and removal of social disabilities. This is a glimpse of some of the salient ancient customs and manners of the people of Kerala and the rapid strides in social progress along modern lines. The progress, has been notable. One conspicuous characteristic of the progress that stands out is that an intelligent differentation is distinct in what is jettisoned and what is preserved. To illustrate, the intense religious fervour, impeccable standards of personal cleanliness, simplicity in matters of taste and attire, and a passion for education and learning out stripping the political transformation is a clear-cut example of this trend.

Women in Kerala from early days enjoyed to a large extent, the freedom to lead an active outdoor life and to commune with nature. They enjoyed along with men the right for recital of the Puranas and *Ithihasas*, the performance of Sanskrit dramas, and indigenous arts like *Kathakali*, *Patakom* etc. in the family quadrangle and in the temple precincts. Festivals like Onam and *Thiruvathira* were occasions for social contacts and for the exhibition of literary and musical talents andfolk dances. Both the high and the low knew to read and write, to sing and dance. Ancient texts like *Chilappathikaram*. *Chandrotsavam*. contain innumerable references to the female prowess in diverse fields such as dance, poetry, music, language, Sanskrit and Malayalam, martial arts. Today Kerala leads the other parts of India in Women's education. Women in Kerala occupy high position in every walk of life including athletics, education, judiciary, medicine and engineering. The bulk of the nursing profession in India and the Gulf region is drawn from Kerala. The

new woman' has a finer rhythm of life, a wider outlook and a broader vision than her sister of the previous century. She can now boast of not only an intense social empathy but also a civic and national consciousness. She has used her freedom rationally and in spirit of equality. Modesty or feminity has never been at a discount, nor simplicity discarded at the altar of fashion. Education has only aroused the intellect, widened the outlook and intensified the national and civic ethos.

Kerala insulated geographically by the Western Ghats, has a cultural entity of her own. Nevertheless it shows with the rest of India, a unity' of culture having an unbroken continuity between the past and the present. From very ancient days, the Indian continent-Bharata Varsha—has had a culture which is basically the same throughout. Differences in language or in political set up had only split the single culture into colourful and diversified spectrum; Sanskrit has been to a considerable extent, the vehicle of our culture, the repository of our spiritual love, philosophy, mythology, law, literature etc. It has shaped andenriched almost all the languages in the country, particularly the Malayalam language, which has assimilated and appropriated Sanskrit sounds, words and idioms in a very large manner.

The cultural affinities of Kerala with the rest of South India are still deeper and more intimate. The territory south of the Vindhya ranges, comprising mainly the Telugu, Kannada, Tamil and Malayalam speaking areas had at one time a common language or Dravidian stock—the parent of the 4 modern Dravidian languages.

There is yet another aspect of life and history which deserves special mention. The cosmopolitan outlook and character of the Keralite is the result of historical causes-the wide ranging external contacts—dating back to millennium preceding the Christian era. At their nadir, the empires of Egypt, Babylonia, Assyria, Greece, Rome, the Chinese—had trade relations with Kerala. They were later followed by the Arabs, Portuguese and finally the British. The Kerala chieftains and in particular the Cheraman Perumals and the Zamorins accorded them all the facilities. The advent of the apostle St. Thomas during the

early period of Christianity, helped the spread of Christianity in Kerala, more than any other place in India. The earliest Muslim mosque in India is to be found near Cranganore. Like-wise the appearance of Jews in Kerala dates to ancient times. The Jews set up a colony in Cochin and built their Synagogue. The Hindus, the Muslims and the Christians live in Kerala side by side each influencing and being influenced by the culture of the other. This accounts for the remarkable degree of religious tolerance and catholicity of outlook which characterise the Keralite.

The preparation of this volume is in conformity with a unified scheme as laid down by the erstwhile Gazetteers Unit, Department of Culture, Government of India.

History today is no longer a chronological catalogue of monarchs and their varied achievements in diverse fields ranging from aggression to matrimony and religious zeal. In the changing circumstance, especially viewed against the given political set up, the Gazetteer offers to the reader a kaleidoscopic picture of the myriad activities of the populace. It is a vast one-piece canvas wherein the totality of life in its variegated hues is portrayed. The Gazetteer is an integrated whole whose components are the geographical, historical, economic, administrative, literary, cultural and philanthropic aspects of life-in short something about everything. It aims at catering to the needs of the general reader and provides the lead for any scholar to choose any subject from the whole list of chapters like geography, history and the Socio-ecónomic phenomena. This inter-disciplinary polymathic work requiring serious academic and journalistic expertise was prepared against heavy odds, virtually single handed, lone exception being the prodding of my friend and Editor, Shri A. Balakrishnan in the absence of adequate staff having the requisite background. This time-consuming work was accomplished within a span of one year by exerting the maximum especially in the circumstances when no effort in that direction has been made by my predecessors in office.

The talents and scholarship of Specialists have been utilised

in the preparation of the sections on Flora, Fauna, Geology, Physiography and Climatology. The section on Fauna written by Dr. Sripathy Prasad, Professor, Department of Zoology, University of Kerala and Physiography by Shri N.J.K. Nair, Head, Resources Analysis Division, Centre for Earth Science Studies, Trivandrum are unique contributions which they undertook as labour of love and not in consideration of the remuneration paid to them. Shri Manilal Kothari, Professor, S.N. College, Quilon, who wrote the section on Flora, has tried to evolve a narration of the rich flora of our State. Shri K. Rajendra Babu Educational Officer, Department of Museums and Zoos, Trivandrum who vetted the section on Fauna, Shri Nootan Das, Deputy Director General of Meteorology (Climate and Geophysics), Pune who contributed the section on Climate, and climatological maps, Director, Geological Survey of India, Kerala Circle, Trivandrum who supplied the Geology and Minor Resources of Kerala drawn mainly from the Miscellaneous publication No. 30 of the Geological Survey of India, Sarvashri S. Krishna Moorthy, Director and S. Ayyappan Nair, Deputy Director, Mining and Geology, Trivandrum who did the vetting of the section on Geology are the others to whom I feel bound in gratitude. Dr. Harsh K. Gupta, Director, Centre for Earth Science Studies and Shri N.J.K. Nair, Head, Resources Analysis Division, Centre for Earth Science Studies, deserve special mention for having prepared and furnished the maps included in this book.

The preparation of this volume commenced under duress and I was in the doldrums as my superannuation was fast approaching. The generous gesture of the higher authorities, specially Shri K. Karunakaran, Chief Minister of Kerala, Shri T.M. Jacob, Minister for Education, Kerala and Shri M.S.K. Ramaswamy, Commissioner and Secretary, Higher Education in permitting me to continue the work even after superannuation has to be gratefully acknowledged and appreciated.

The unstinted support and co-operation at all stages of work by Shri A. Balakrishnan, Joint Director, Directorate of Economics and Statistics working as Editor was to a great extent instrumental for the successful completion of this venture.

To Smt. J. Sarala Devi, Confidential Assistant and Shri P. Balakrishnan Nair, Smt. P. Sulochana Bai and Shri P. Thomas, Senior Grade Typist who did all the tiresome typing and retyping of drafts, I am deeply grateful. Sarvashree V.A. Abdul Khader, Sub Editor, C.A. Chandrika, Head Clerk, G. Antony and M. Devasahayam, Peons are the others of the establishment to whom thanks are due.

I am grateful to Shri K. Asokan, Managing Director and Shri M.C. George, Production Manager and the staff of Kerala Books and Publications Society for the keen enthusiasm displayed in the publication of the book—a pioneer attempt in their MONOCOMP Photo typesetting machine.

Trivandrum *ADOOR K. K. RAMACHANDRAN NAIR*
1 — 1 — 1986 *STATE EDITOR*

CONTENTS

CHAPTER I

GENERAL

1. Origin of the name of the State

There are many theories regarding the origin of the names Kerala and Malabar and most of them, to a very great extent, shrouded in the mists of tradition. Rev. Fr. Heras reads in a Mohenjodaro pictograph Karmukil Malayalam adu (Malabar of the rain clouds). If the inference is taken as correct, it is obvious that Kerala as a geographical unit must have existed as early as B. C. 2500. On the basis of the microliths discovered at Calicut and Cochin, it is claimed that Kerala had become the abode of man in about B. C. 400. Kerala was known to the Greeks[1] and Romans and is mentioned in the inscription of Asoka; in Kautilya's *Arthasastra*, in the great epics of *Ramayana* and *Mahabharatha* and in the works of Kalidasa. The earliest epigraphic record that mentions Kerala is Asoka's Rock Edict II[2] of B. C. 257. In it the name of the country is called Keralaputa'. This name corresponds to Pliny's *Celobotras* and Ptolemy's *Kerobotros*[3]. *P. T. Srinivasa Iyengar tried to correlate Kerala* with the *Cherapadh* of the *Taittiriya Arayanka* and the *Seri* of the Buddhist *Jatakas*. Likewise V. R. Ramachandra Dikshitar attempted to connect it with *Charia* in Asia Minor. According to the Sanskrit work *Harivamsa* it is claimed to be named after

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1. Megasthenes, the Greek Ambassador in the Court of Chandragupta Maurya speaks of Kerala as the land of the *Cheraman*.

2. Girnar Text reads : P. 41—42, Inscriptions of Asoka, D. C. Sircar, 1975 Delhi—Everywhere in the dominions of King Priyadarsi, Beloved of the Gods, and likewise in the bordering territories such as those of the Chodas and Pandyas as well as of the Satiyaputra and the Keralaputra as far south as Tamraparni .... everywhere king Priyadarsi, Beloved of the Gods, has arranged for two kinds of medical treatment, viz., medical treatment for mena and medical treatment for animals.

   Keralaputa or Keralaputra is considered as the North Indian equivalent of South Indian Cheraman. The Cheras, it is believed, originally were a family of rulers whose kingdom roughly corresponded to the Western and the South-Western parts of the Tamil country according to Sangam works. The Chera country being hilly was included under the classification of land *'Kurinchi'* of the early Tamil literacy convention. According to *Purananuru* Chera-nadu

was called Kudanad meaning western country. *Patittipattu* describes that Cheras were called Kuttavans who ruled over Kuttanad and it lays down that Palyanai Selkelu Kuttavan. the hero of Pattu III has earned the title by his conquest of Kuttanad from the Pallavas. S. K. Iyengar treated the surname "Satpute" to mean Satiyaputra occuring in Asoka's Edict, as a collective name of the various matnarchal communities like the Tulus and the Nayars of Malabar and located them in the region north of Cochin. The contention of Dr. S. K. Iyengar that *Satiyaputra* occuring in Asokas's Rock- Edict II referred to the Nayars of Kerala (meaning sons of Chaste-woman) has been refuted by V.A. Smith (early History of India. p. 185) and K.A.N. Sastri (A History of South India, p. 83). The Kerala Putras referred in the Asokan inscriptions mentioned of the Cheras who ruled over the region to the west of the Kingdoms of the Pandyas and the Cholas. Their capital was Vanji, the identification of which place has been a subject of great controversy among scholars of South Indian History, some identifying it with Thiruvanjikulam on the river Periyar and some with Karur in the Tiruchirappalli district. A Brahmi inscription near Pugalur in the Karur taluk mentions one Kosipan Atan, the word reminds us of one Atan a name borne by Chera Kings. (Annual Report of South Indian Epigraphy 1927-28, No. 348). At the same time a Chola inscription mentions Karuvur *alias* Vanjimanagar in the Vengala nadu, a sub-division of Vira-solamandalam. B.M. Barua remarks that from the location of Asoka's Rock and Minor Rock Edicts, "it may be inferred that the country of *Satiyaputa* or *Satiyaputra* lay along the west coast of South India to the South of Sopara and the Chitaldurg District of Mysore, and the north of Keralaputra (Ibid No. 335) (B.M. Berua Inscription of Asoka II. pt. ii, p. 180). On philological grounds K.G. Sesha Iyer identifies the Atiyamans of the Sangam age with the Satiyaputra of the Asoka's inscriptions. He says: "the initial *a* (in Atiyaman) becomes *ha*, which again becomes *sa* in *Prakrt;* and man is abbreviation for *magun* which means putra; and thus Atiyaman becomes Satiyaputra on the analogy of Ceraman equals Keralaputra........The identification here suggested on Atiyaman with satiyaputra satisfactorily accounts for the presence of the participle in the name appearing in Asoka's edict". (Chera kings of the Sangom age Page 18). T.V. Mahalingam is of the view that in identifying the Satiyaputras the Order in which the South Indian powers outside the Mauryan Empire of Asoka are mentioned has to be taken into account. He remarks the Tamil country may be vertically divided into two halves the east and the west. In the former are mentioned first the Colas and then the Pandyas. In the latter are mentioned first the Satiyaputras and then the Keralaputras. In the same way as the Colas were to the north of the Pandyas in the eastern half, the Satiyaputras must have been to the north of the Keralaputras in the western half If that be so, it is not improbable that the Satiyaputras were the same as the Adigaimans of Tagadur, who had an important place in the political set up of the Tamil country obviously from the days of the Mauryas, an ancient tribe in the Tamil country, as may be gleaned from the references to them in early Tamil literature. (Early South Indian Palaeography, p. 186).

3. Ptolemy's *Cottanora* from where pepper was exported to Rome referred to Kuttanad (K.P.P Menon -- History of Kerala, Vol. III, p. 38.)

one of the four sons of Akrida, the others being Pandiya, Kola and Chola[4]. The description of Kerala by Kalidasa as *Dooran Muktanudanuan* (long extending liberation from the sea or in other words a gift of the sea) of course refers to the wellknown Parasurama tradition. This tradition like other legends of Indian mythology is centred round the story of a celebrated conqueror by name Parasurama but it is scarcely possible through the mist of fable even to conjecture anything respecting the real existence of the personage or events connected with him. The Grecian Iliad and Odyssey are in comparison with our legends and authentic chronicles. Antiquarian research is only now beginning to find means of supplementing the deficiency caused by the absence of materials constructed or collected by usual historic methods. The most ancient facts about Kerala, like the rest of South India, are remarkable. Geology and natural history make it certain that at a time within the bounds of human knowledge this part of our motherland did not form part of Asia. The Sanskrit Puranic writers, the Sri Lanka Buddhist literature and the local traditions of the West Coast, all indicate in different manners a great disturbance of the point of the Peninsula and Sri Lanka within recent times[5]. The geological and geographical features of both South India and Sri Lanka are similar in several

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4. See the article on Reflections on the "Genesis of Kerala" by T.V. Kuppuswamy. Journal of Kerala Studies 1975, Vol. II, part I, p. 4.

5. Scientists now conclude that about 180 million years ago, South America and Africa were locked together and there was great land mass South and South-west of present day India extending right upto the South American—African land mass. All this is geologically termed as Gondwana land. Scientists have also established that during the last 100,000 years, there have been five cataclysmic changes in this region as result of which large parts of the land sank under the sea and South America and Africa were separated. The land mass which sank was called Lemuria. South America and Africa continue to move away from each other even today at the rate of about 3 centimetres per year. When large parts of Lemuria sank, the rest of the land mass started moving northward and formed the present day-Indian sub-continent including Ceylon. The last cataclysmic change which is said to have taken place at about 2700 B.C. is recorded in ancient Tamil literature. For details see — Gems from Pre-historic Past: Edited by N. Mahalingam and published by International Society for the Investigation of Ancient Civilisation, Madras, 1980.

respects[6] on the basis of which Wilhelm Geiger rightly concludes that, in times gone by, Sri Lanka was an out-stretched region of the Dekkan plateau. He says: "Ceylon is essentially a part of the Dekkan, the vast plateau of South India and consists geologically of a solid mass of pre-cambrian crystalline rock, chiefly Biotitegneiss with bands of white crystalline limestone"[7]. The similarity of flora and fauna with those of South India also points to the fact that the two were originally parts of the same land mass. The English theologians assign this Noachian deluge to 2348 B.C. and the Sri Lanka Buddhists to the latest submergence in the region of Sri Lanka to B.C. 2387. This evidently lends support to the Parasurama tradition which is couched under the garb of divine grandeur. According to the popular Parasurama legend, the land crust that forms Kerala was raised from the depths of the ocean as a result of the severe penance by Pàrasurama, the Brahmin Avatar of Vishnu for his revengeful wars and destructive campaign against the *Kshatriyas*. The turbulent God Parasurama flung his battle-axe far out into the heaving sea and waters extending from Gokarnam to Kanyakumari receded and the land of Kerala emerged into sun and air. Whatever might be the historical basis of this tradition it is generally believed that this points to the seismological factors that led to the emergence of the land. There is certainly some scientific evidence regarding the aqueous origin of our land. Some geologists contend that in a former geological

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6. "Geologically speaking, Madagascar, Sri Lanka and South India afford resemblances. The presence of a series of rocks of a similar nature in these areas supports the suggestion that these areas once formed part of one land mass". V.R. Ramachandra Dikshitar: Pre-historic South India (1957.) p.

7. Wilhelm Geiger, Culture of Sri Lanka in Medieval Times. Ed. by Heinz. Bechert (1960), p. 1. Alexander Kondratov, the Russian Scholar has the following pertinent observation to make: "Geologists have advanced a hypothesis that a great land bridge once connected India and Africa. The long steep projection of the Eastern and Western Ghats, the mountain ranges that separate India from the ocean suggests that land subsidence on a vast scale once took place here. Volcanic lava reaches down into the ocean to a depth of one Kilometre. It is possible that the sea flood was once land and the Ghats arose when this land sank to the bottom of the Indian Ocean to the west of the mountains. Many geologists are of the opinion that the whole of the Indian sub-continent is a vast flat chunk of land left over from a land mass whose western part sank into the ocean while the Island of Ceylon, in its turn, is part of the Sub-continent".

period there was a vast fresh water lake of which the eastern shore roughly represented the present coast line of Kerala. But this contention is refuted on the ground that if it was a fresh-water lake it could not have had any connection with the sea. According to the majority opinion the fact is that the Parasurama legend referred to the period when Kerala had attained stability after some seismic catastrophy. It is also contended that the silting up process was slow and lasted for centuries. According to I.C. Chacko the state of things indicated by the Parasurama legend came into being at least 2000 years before Christ[8]. The Western Ghats which form the eastern border of the State showed definite evidence of a geological cataclysm in the gaping discontinuity of the Palghat gap which is about 30 kms. broad. Here the mountains appear thrown back and heaped up as if some overwhelming deluge had burst through sweeping them to left and right. On either side there are the towering Nilgiris and the Anamalais over topping the chain of Ghats by several thousand metres. The coastal belt of Alleppey district is like a sandy sea-shore which has been extended inland. Marine fossils including coral reefs have been unearthed near Vazhappally in Changanacherry. Geologists therefore feel that the Arabian sea must have once extended right upto the foot of the Western Ghats. A cataclysm could have resulted in the sea receding and the submerged bed emerging to the surface. The numerous rivers which take their source in the Western Ghats could have subsequently brought down much quantities of silt and mud and deposited them on the newly formed coastal region. A section of the geologists are of the view that subterranean passages link the sea with the rivers and backwaters inland, the accumulating silt in them finds its way into the littoral currents and thereby leads to form mud banks. Mud banks occur along with the sea board from the Kotta river to Cape Comorin the most remarkable being those of Panthalayani Kollam, Calicut and Alleppey. These banks have been known to mariners from very ancient times as smooth and safe anchorages, even when the sea is rough. However Kerala is a littoral State with its 44 rivers seeking their source from the

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8. Journal of the Ramavarma Research Institute Bullettin, Volume Xii — 1945 Trichur, p.11. See Appendix I.

Sahyadri and flowing westward to find their fusion with the Arabian Sea. Kerala represents a riparian civilisation unique and unparallelled anywhere else in India.

Among the many explanations offered for the name of the land, the most probable is the one which refers to the above origin. The simple fact that the name Kerala is found in the *Ramayana* or *Mahabharatha* or in several of the *Puranas* such as the *Vayu*, *Malsya*, *Markandeya*, *Skanda*, *Padma* and so on and in the works of Kalidasa, Rajsekhara and other Sanskrit poets cannot make it certain that the word is of Sanskrit origin. *Cheralam* and *Cheram* are other names used with references to Kerala. Dr. Caldwell thinks that "probably Kerala was the earliest form of the word, Kerala a Sanskrit derivative[9]. One meaning of the word *Kera* is coconut palm. But Caldwell says "It must be only a secondary meaning, the name of the country itself being probably the origin of this name of its most characteristics tree"[10]. Some scholars derive the name of Kerala from the word *Kera* (Coconut). It is one of the characteristic products of the West Coast. But Dr. Gundert observes that the word *Keram* is the Canarese form of *Cheram* and he describes *Keralam* as *Cheram*—the country between Gokarnam and Kumari. The interpretation that Kerala means the land of *Kera* or coconut palm is not tenable from the philological and historical[11] points of view. The origin of the term may probably be from the root Cher which means to join. It seems to be the most appropriate interpretation because it points to the geological fact that the region was under submersion at a remote period of history and afterwards when the ocean drew back it was joined to the Southern peninsula which is embodied in the Parasurama tradition. This meaning is clear in the compound word *Cheralam* in which *Alam* means region or land. *Cher* also means added and to give the meaning the land which was added by the recession of the sea.

9. A comparative Grammar of the Dravidian Languages (Reprint), p. 22, Delhi, 1981.
10. Ibid, p. 22–23.
11. There is a contention that as coconut is not mentioned in the lists of exports here is a contention that as coconut is not mentioned in the lists of exports given by Periplus (1st century A.D.) but as Cosmos Indico Pleustus (6th century A.D.) fully describes it, it was introduced in the third or fourth century A.D. But references in the Ramayana belie the above contention. The date of the Ramayana may be taken as 3rd century B.C.

General

Malabar is another name given to the country.. This term was used for the first time in 1150 A. D., after the coming of the Arabs to this land. It has various forms with the change of vowels—*Malibar, Manibar, Mulibar, Munibar.* The early European travellers used other forms which were written *Melibar, Minibar, Milibar, Minubar, Melibaria, Malabaria* etc. Cosmos Indico Pleustus (6th century A. D.) the Egyptian merchant mentions a town *Male* on the West Coast of India as a great emporium of pepper trade. Al Biruni (970-1039 A. D.) appears to have been the first to call the country Malabar. The celebrated author of the Manual of Malabar suggests that the name Malabar is of semi-foreign origin. To quote him "the first two syllables are almost certainly the ordinary Dravidian word *Mala* (Hill, Mountain) and *Bar* is probably the Arabic word *Barr* (continent) or the Persian *Bar* (country)". According to him the name is reminiscent of the word *Malanadu* which literally means the hill country. Many variants of the name are found in the ancient Mohammedan and European writers. Lassan thinks that bar is identical with Sanskrit *Vra* (Region) and that the form might have been *Malayavara*. *But Dr. Caldwell did not accept this derivation on the ground that this term is never found used. Dr. Gundert suggested the possibility of the* derivation of *Bar* from the Arabic *Barr* meaning continent. According to Col. Yule Bar is a Persian word appearing in Zansibar, Malabar[12] etc. During the Gampola and Kotte periods in the History of Ceylon, Kerala is referred to as *Malala*[13] Bishop R. Caldwell is of the view that the origin of the name is from Ma'bar literally meaning the passage. It was the name given by the early Arabian merchants to that portion of the Coromandal Coast which was nearest Ceylon and from which it was easiest to pass over to the island from the continent[14]. The Portuguese call the inhabitants *Malabares*. But all these derivations seem to be wrong

12. Linguistics — General and Dravidian, Chathanath Achuthan Unni. p. 158.

13. "People from Malabar had been in Ceylon at least from the medieval times and they figure quite prominently in the political history of the country during the Gampola and Kotte periods, their country is referred by the name Malala and Kerala, which are sometimes identified" Prof. Hettiara Chchi. University History of Ceylon, Vol. I, p. 39.

14 History of Tinnevelly, p. 36, Reprint, 1982, New Delhi.

and far fetched in view of the fact that the country is called *Mala-nadu* in medieval Tamil and early Malayalam. The term Malabar is a corruption of the alternative word Malavaram* (Hills slope) which also means *the hill country*. In this connection the derivation of the word Nicobar from *Nakkabaram* (the land of the naked) may be cited. There is no doubt that the word Malabar is a westernised form of *Malavaram which means the hilly country*.

2. Location, General boundaries, total area and population

Kerala, the southern most state of India occupies a unique position on the map of the country. With the southernmost extremity at Parassala about 56 kms. up from the lands end of *India*, it stretches along the shores of Arabian sea for a distance of about 580 kms. with Karnataka State on the North and North-east and Tamilnadu State on the East and South. The breadth of the State varies from 32 kms. in the extreme North and South to over 120 kms. in the middle. It is hemmed between the mighty Western Ghats and the Arabian sea.

Kerala State lies between 8°.17' 30'' and 12° 47' 40'' north latitudes and 74° 51' and 77° 24' 47'' east longitudes.

The State is bounded on the North and North-east by South Kanara, Kudagu and Mysore districts of Karnataka State, on the East by Nilgiris, Coimbatore, Madurai, Ramanathapuram and Tirunelveli districts of Tamilnadu, on the south by Kanyakumari district of Tamilnadu and on the west by the Arabian sea. The area of the State is 38,863 sq. kms. Kerala ranks seventeenth in area among the 22 States of India. The area of the State works out to 1.18% of the total area of the country.

According to the 1981 census, Kerala has a population of 25,403,217 persons of whom 12,487,961 are males and 12,915,256 females. The population of the State is 3.71% of the population of India. One out of every 27 Indians and one out of every 173 humans in the world is a Keralite. Considering the size of the population the position of Kerala is twelfth among the 22 States in India.

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* Under the well-known rule of Grammer *Bavyorabheda*, the letters *ba* and *va* are interchangeable.

3. History of the State as an Administrative Unit and changes in its component parts

The boundaries of ancient Kerala were rather indeterminate. In its widest sense it extended from Gokarnam to Cape Comorin. The *Keralolpathy*[15] divided Kerala into four *Khandams* or provinces. The different versions of the *Keralolpathy* have confused the boundaries of ancient Kerala. According to the work there was a time-honoured division of *Parasurama Kshetram* (kerala) into *Tuluva*, *Mushika*, Kerala and *Kupaka*[16]. *Tuluva* comprised of the territory between Gokarnam and Perumpuzha or Chandragiri river; *Mushika* lay between Perumpuzha and Puthuppattanam; Kerala between Puthuppattanam and Kannetti, a few miles north of Quilon and *Kupaka* between Kannetti and Cape Comorin. Another version of the work gave the division in the order of *Tuluva*, Kerala, *Mushika* and *Kupaka*[17]. A third version gave these divisions in the order of *Tuluva*, *Kupaka*, Kerala and *Mushika*[18]. Thus when an attempt is made to delineate precisely the boundaries of ancient Kerala, considerable difficulty is posed by the differing versions of the *Keralolpathy*. The *Mushikavamsa* in Sanskrit dealing with the regional history of Northern Kerala, refers to Kerala, Chola, Pandya and *Mushika* as independent Kingdoms. T.A. Gopinatha Rao depending mainly on legendary sources observed as follows:"In the medieval and later periods the country was split up into a larger number of Principalities; the chief ones among them seem to have been - *Mushika* country belonging to the Kolathiris, the *Kupakas* of Kollam and the Venad kings of South Travancore. The part of

15. *Keralolpathy* records events and personages of the early periods of Kerala history. There are many works in Malayalam that go by the name. Mahakavi Ulloor records that there were several versions of this book which differed from region to region. Modern research has unfolded a large number of historical inaccuracies and anachronisoms in this work. It is also contended by some scholars that certain statements contained in it prove beyond doubt that it was compiled during the period of British administration in Kerala.

16. Basel Mission Press, Mangalore. ,p. 19.

17. Kerala Charithram. Shri Vanchi Sethu Lakshmi Series No. 18, Trivandrum. 939. p. 18.

18. T. A. S. Vol. II, P. 106

the Malabar north of Kollam and adjoining the Coimbatore and Nilgiri districts and the Mysore province appear to have been known in Kerala"[19]. Monier Williams[20], K. P. Padmanabha Menon[21], V. Nagamayya[22] etc. have all given different versions on the division of ancient and medieval Kerala.

From the geography of *Tamizhakam* as revealed in Sangham works, there were three important kingdoms in Kerala in fifth century A.D. In the south was *Aynad*, in the north, the *Ezhilmalainad* and in the centre *Cheranad*. *Puzhinad* or North Malabar and the Kasargod regions were parts of *Ezhilmalainad*[23]. Chera is always spoken of in tradition as well as in written authorities as contemporary with Pandya and Chola. A stanza by the great Sangham poet Auvvaiyar[24] gives the northern boundary as Pulney, as the eastern Shencotta on the frontier between Travancore and Tirunnelveli, as the western, Kozhikode and as the southern, the sea. Another stanza of the same poet makes the Tirunnelveli-Thenkasi as the eastern boundary. There are grounds for supporting that old *Cheramandalam* included once the present Karnataka, Coimbatore and Salem, the old *Thondeinad* and the present Palghat and Cochin. To the South-east it was always confined by Pandya and Chola. Thus it may be seen that Kerala in ancient times was under the sway of the Chera kings as a cohesive unit, and continued to be so for several centuries when the vicissitudes of history fragmented the land into petty principalities. The chieftains of these principalities unable to accept local overlordships, chose as exogamous nobleman known as the Perumal of the Chera dynasty for political sovereignty.

19. T. A. S. Vol. II, P. 54

20. A Sanskrit English Dictionary, Oxford, p. 827.

21. History of Kerala, Vol. I, pp. 2 and 35.

22. Travancore State Manual, Vol. I, pp. 223, 232 etc.

23. Studies in Kerala History, Elamkulam Kunjan Pilli, p. 41.

24. The northern-most place is pulney. The most east is Shengode. On the west is Cozhicod. The shore of the sea is on the south. Say that some eighty *Kathams* make the boundary of the Chera country. Pulney in this stanza probably refers to the river Parne or Parnaimpuzha (Perar or Bharathapuzha).

This tradition in the legendary accounts gives a glimpse of the state of political organisation of an extra-ordinary structure prevalent in Kerala in the ninth century A.D. The government was vested in a hierarchial council, formed of the Brahmins of the sixty-four gramams[25] (villages) into which the country was divided. The Brahmins rented the land to the inhabitants of the country, reserving to themselves the right of property in the soil and the management of public affairs. The defence of the whole country and the use of weapons were entrusted to ten divisions and a half out of the sixty-four villages and the executive government was consigned to one person and a council of four others appointed by the Brahmins of the sixty-four villages for three years. This led to the origin of the customs of rotation of rulers where in every twelve years the overlord was changed. These arrangements in course of time might have led to the election of one ruler of the military caste who took an oath on assumption of office to acknowledge the authority of the Brahmins and do nothing contrary to their interests with or without their

25. All versions of the Parasurama tradition makes mention of these 64 *gramams*. Sixty-four villages or gramams were (1) Gokarnam, (2) Gomakutam, (3) Karavalli, (4) Mallur, (5) Eppanur, (6) Cheppanur, (7) Katalur, (8) Kallannur, (9) Karyachchira, (10) Peiyanchira—this was the first group in the extreme north of the newly reclaimed land— (11) Trikkani, (12) Trikkatta, (13) Trikkanpala, (14) Trichchola, (15) Kollur, (16) Komalam, (17) Vellara, (18) Vengatu, (19) Venkatam, (20) Chengottu—another set of ten gramams presumably to the south of the first group and all lying in North Canara or Tulunad, (21) Kotisvaram, (22) Manchisvaram, (23) Utuppu, (24) Sankaranarayam, (25) Kottam, (26) Sivalli, (27) Mora, (28) Pancha, (29) Vittal, (30) Kumaramangalam, (31), Anantapuram, (32) Kannapuram—a group of twelve gramams lying in south Canara or Tulunad, (33) Peiyanur, (34) Perinchellur, (35) Karikkatu, (36) Isanamangalam, (37) Alattur, (38) Karintolam, (39) Trissivaperur, (40) Panniyur, (41) Chovaram — these though only none in number are said to have formed another group of ten gramams, (42) Parappur; (43) Eiranikkulam, (44) Mushikakulam, (45) Iringatikkotu, (46) Atappur, (47) Chenganotu, (48) Uliyanur, (49) Kalutanatu, (50) Kalachchur, (51) Ilibhyam, (52) Chamundha, (53) Avattiputtur—another group of twelve gramams, (54) Katukaruka, (55) Kitangur, (56) Karanallur, (57) Kaviyur, (58) Ettulaniyur, (59) Nilmanna, (60) Anmant, (61) Anmalam, (62) Tiruvallayi, (63) Chenganiyur. One of the names has probably been lost. The last named thirtyone gramams seem to belong to Malabar proper and the Native States of Cochin and North Travancore; but some of the names of places cannot now be identified, nor are the names which can be identified arranged in strict order proceeding from north to south — Logan, Malabar 1981, TVM., P. 259.

concurrence. The end of the reign of the Cheraman Perumals was a turning point in the history of Kerala. The termination of the Perumal's reign was followed by a division of the country among local ruling chieftains which provided ample scope for mutual rivalries and feuds. The weakening of solidarity in its turn led to the invasion of Muslim adventurers and later the consolidation of power in the hands of foreigners in different parts of Kerala. These events of the ninth century which led to the division of the country and the exit of Perumal was certainly a period of political convulsion. The history of the political organisation of Kerala between ninth and fifteenth centuries is imperfectly obscure[26] The Portuguese found the country split into numerous petty principalities acknowledging a sort of feudatory obligation to a few of the more powerful of their numbers but all affecting independence. The lineal descendant of the last Perumal was the Raja of Cochin. Among the superior chieftains was that of Calicut, whose titular head *Samoothiry raja*, the Portuguese called the Zamorin of Calicut. Another chieftainship was *Venad*.

The territorial divisions of Kerala followed to a very great extent the caste groupings. The management of the affairs of the districts and villages was the responsibility of prominent citizens of the localities. According to the historical archaeology, there were in ancient Kerala organisations such as the *Three Hundred*, the *Five Hundred*, the *Six Hundred* and the *Five Thousand* which checked the despotism of the local rulers and preserved the rights and privileges of the people at large. Kerala was divided into several *Nads* under local chieftains called *Vazhkai Vazhis* who were responsible to the Raja. Each *Nad* consisted of *Desoms*, *Karas*, *Taras*, *Cherries* or other similar divisions. The popular assemblies in these divisions and sub-divisions were called *Kuttams*. Accordingly the *Kuttam* of the *Tara* or *Desom* used to discuss purely local issues and that

26. Modern historians on Kerala History like Prof. Elamkulam Kunjan Pillali is of the view that after 800 A.D. it becomes possible to reconstruct the history of Kerala on a firm foundation of historical records separating fact from legend and fantasy. The period between 800 and 1102 A. D. is according to him the golden age of Kerala History. This period is described by him as the period of the second Chera Empire. The Kulasekharas were ruling over Kerala during this period with their capital at Mahodayapuram The period also

witnessed the rise of great sages and seers like Sankaracharya, Kulasekhara Alwar, Cheraman Perumal Nayanar and a host of others. The cultural symbiosis of Kerala took a definite shape during this period. The language of Kerala also assumed an independent character. The period marked the first rays of an all pervasive transformation in an effulgence of splendour. The region to the south of Cochin known as Venad and centering on the sea coast town of Quilon was politically one of the most important divisions of the Kulasekhara realm. The other districts of Kerala were ruled by Governors or *Naduvazhis* who had a certain measure of independence. The Empire which lasted for more than three centuries were politically dominated by the relation between the Cheras and the Cholas. With the victory of Raja which is referred to in his Suchindram inscription of 30th Kanni 175 Kollam Era (A. D. 999), the whole of South Travancore south of Kuzhithura became part of Raja Raja Pandinad as the southern most administrative division. The Chola invasion came as a tragic shock to the political and cultural oneness of Kerala which the Cheras built up and maintained for more than three centuries. The next hundred years saw many attacks on Kerala by the Chola army. This period of Chera-Chola war is known as "Hundred Years War" in Kerala History. The Chola inscriptions of Raja Raja speak of him as having defeated 18 kings of Kerala. The Chera military strength was destroyed by 1045 A.D. For the next 80 years the rivalry between the Cholas and Cheras continued until Ramavarma finally drew out the foreign invader by the end of the 12th century. Kerala during this time was divided into small kingdoms under petty chieftains. This state of affairs continued until the advent of the Portuguese and the Dutch.

The loss of political unity did not led to the loss of political independence in Kerala. Each minor chieftain who became the ruler of a small principlity claimed it as the gift of the last Cheraman Perumal. The Cochin rulers profesed to be the direct descendants according to the matrilineal order, the rulers of Venad traced their origin as the patrilineal decendants of the Kulasekharas and adopted the name of Kulasekharas as a hereditary title. The rulers of Ernad (Zamorin) based their claims on the last Cheraman's gift of sword with the instruction "to die and kill and annex". The Raja of Valluvanad claimed his legacy as the President of the great Mamankam festival at Thirunavai. Kólathiri cherished the Chera system of administration as a sacred trust. There were many other small principalities, but everyone of them reckoned their history from the last Cheraman Perumal. All these, whether myths or facts, go to show that basically the Chera political institution haunted the destiny of Kerala for many centuries more. The rulers of Ernad known as the Zamorins of Calicut grew in prosperity and power and managed to bring the neighbouring chieftains within the sphere of their influence. The support of the Arab wealth and equipment favoured Calicut against Cochin during the 13th, 14th and 15th Centuries till it was counter-balanced by the European powers—the Portuguese and the Dutch on the other side. In short the political power of Kerala was controlled by Kozhikode in the north, by Cochin in the Central part and the Venad of Travancore on the southern part.

of the *Nadu*, matters of greater and general importance. These *Kuttams* functioned vigorously in the past. They played a significant role in arousing public opinion against the unilateral autocratic acts of the rulers. Velu Thampi and Pazhassi Raja made use of these *Kuttams* in their fight against royal autocracy and foreign domination. It cannot however be denied that judged by modern standards, the democratic and representative character of these institutions suffered from certain drawbacks. The *Kuttams* were dominated by the Brahmin and Nayar aristocracy and were not fully representative of the people. Dr. John Mathai remarked that the institutions of village self-government which prevailed throughout India were hardly in existence in Kerala[27]. In his view the system bore the characteristics more of a feudal society than village communities. Nevertheless these local territorial units functioned actively in some form or other in ancient and medieval Kerala till the collapse of the self-sufficient economy under the impact of British rule in the nineteenth century.

Venad was the most powerful chieftainship of the southernmost Kerala lying between Quilon and Trivandrum with its capital at Quilon. Till the accession of Ravi Varma to the throne of Venad in 1684 A.D. each district, sub-district or village was governed by local chiefs. Ravi Varma effected drastic changes in the administrative set up of Venad. The State Establishment was transformed to consist of a *Valiya Karyakkar* (Prime Minister) a *Meleluthu Pillai* (Accounts Officer) Rayasam Pillai (Secretary) and others. All administrative business was transacted only after obtaining royal sanction. This system endured till 1729 when Marthanda Varma became the *Adhipathi* of Venad and succeeded in subjugating the feudal chieftains who had risen against dynastic absolutism[28]. Marthanda Varma launched a campaign of conquest and brought several independent

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27. Presidential Address at the 21st Session of the Indian History Congress. 1958.

28. According to tradition the priestly class predominated the ancient society of Kerala. Assuming ascendancy, they assigned large tracts of land and the revenue derived, to the temples built and consecrated by them. The priests

principalities under his sway, thus creating Travancore. By 1755, Marthanda Varma radically re-organised the internal administration with the village under the *Pravarthikar* as the lowest unit. A group of villages constituted the Mandapathum-*vathukkal* which was under the *Karyakar* who is a proto-type of Tahsildar. During the reign of Rama Varma (1758—1798 A.D.), Travancore was divided into three provinces called *Vadakke-mukham* (Northern Division), *Padinjaremukham* (Western Division), and *Thekkemukham* (Southern Division) each of which was under an officer designated *Valia Sarvadhikaryakar*. Each division was sub-divided into taluks called *Mandapattum-vathukkals* under *Sarvadhikaryakkars*. It was further sub-divided

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became proprietory wardens and entrusted the leading layman or chief of the region to steward the temple domain on their behalf. Thus evolved the rich temples—the Dewaswoms—the early forms of sovereignty in Kerala. The early functionaries were known as *Koil Adhikarikal*. These chieftains, came into their own on the demise of the last Cheraman Perumal. In many instances, the extent of territory ruled by a chieftain exceeded the area of the present day taluk. To illustrate a few of these petty principalities: Ettuvarnad—Nedumangad, Elayadattunad—Kottarakkara, Odanad—Kayamkulam, Iyroornad—Pandalam, Vembanad—Ambalapuzha. Some of these chieftains bore titles such as *Kartha* of Kottayam, *Samandan* of Meenachal, *Medampi* of Shertallay etc. The ruler of Travancore to commemorate his descent from the original Chera emperor, assumed the title of Kulasekhara Perumal. His domain covered the land between Anjengo and Udayagiri—which formed the nucleus of modern Travancore. The village assemblies and ecclesiastical councils, played a prominent role in the administration. The most notable of these administrative bodies was the Council known as *Ettarayogam* or Council of Eight and a half,. This Council comprised of one Nambudiri Sanyasi, six Potti Brahmins and Nair nobleman, each having a vote. The sovereign who was also a member of the council had only half a vote which explains the nomenclature. These village governments came to the fore with the disappearance of Chola ascendancy in Malabar. Prof. Sundaram Pillay in his "Early Sovereign of Travancore" highlights the prominent role of these organizations—citing the Manalikara inscriptions of 410 M. E. (1235 A. D.) he states that the old village *sabhas* (assemblies) of Travancore were permanent and well constituted public bodies acting as buffer between the people and the Government. These Councils fell into disrepute during the reign of weak rulers like Aditya Varma, whose authority was challenged from within by rebel barons—the *yogakars*, and without by the invasion of the Pandyan king Thirumala Nayak. This anarchy prevailed till the reign of his three successors.

and placed under *Karyakkars*, *Manians*, *Kelvies*, *Adhikarams* and *Proverthies* were smaller units under the charge of *Manikarans*, *Adhikaris* and *Pravartikars*. They were assisted by writers, accountants, *rayasams* and sepoys. The king issued *Chatta Variyolas*[29] containing rules of conduct for the officers of the State. About this system Resident Colonel Munroe comments on December 20, 1810 thus[30]. "The whole country is parcelled into a certain number of grand divisions, over each of which a principal officer, termed a Valla Sarwadycar presides, and his authority extends to all matters of a Revenue, Commercial or Judicial nature. These grand portions of the country are again divided into a certain number of parts, each under the secondary controlling management of a Surwadycar, and these again are sub-divided into districts under the management of a Kauriacar, who has under him resident in certain principal places in his district, other officers, termed Pravarticars, who are the last in gradation among the managing officers of respectability; but under them again there are several inferior officers called Chundercars, Torrecars and Bellicars or Peons, who have each a distinct and separate office. Besides the above there is a Melvejauripcar and the nature of his office is purely judicial, but in what particular cases his interference is required, I have not learned. Each of the principal officers

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29. The Chattavariyola issued to the *Karykars* on 1st Avani, 949 K. E. (1773—74 A.D.) contained the following provisions : (a) To get the revenue in paddy and money, collected by the different Provertikars appointed to the several Proverties. (b) To defray the expenses connected with *Devasvam*, *Pujas*, *Iswara Seva*, *Thingal*, maintenance of troops and *Visesha*l or special items. (c) To conduct the prescribed ceremonies in the religious and charitable institutions. (d) To get the accounts of receipts and expenditure written up annually by the *Pillamars*. (e) To receive the emoluments attached to the office. (f) To conduct the administration of the *Mandapathumvathukal* in accordance with *Chatta Variola*.

30. 'Report on the Countries of Travancore and Cochin. Their condition and resources'. Mahadeva Iyer R. The Travancore Land Revenue Manual, Vol. IV, p. 144.

named above has an office establishment of writers, etc., for keeping the accounts of his Cutcherry; the Head Writers in the Cutcherry of the Kauriacar is entitled Terumpoochy Pillai and all those of inferior officers, Pillay".

It was during the time of Rama Varma that the Prime Minister came to be known as *Dewan* instead of Dalawa. Subsequently it was Col. Munro who built up a centralised administration conducted by the Dewan from headquarters with the co-operation of a staff of assistants of whom the most important were two Dewan Peishkars. He re-organised the entire administrative machinery on the lines which prevailed in the Presidency of Madras. At the time of his appointment, there were three *Valia Sarvadhikaryakars*, ten *Sarvadhikaryakkars* and thirty-one *Karyakkars*. He abolished the offices of the *Valiasarvadhikaryakkars* and *Sarvadhikaryakkars*. The designation of *Karyakkar* was changed to Tahsildar. Ward and Conner in their memoir of 1818—20 Observed[31].

"The head of the States enjoys every possible consideration, and as much power and privilege as is necessary to the dignity of the station, or compatible with the happiness of the people. The Dewan, the head of the administration, is still invested with an extensive executive authority over all the departments of Government. The country is divided into thirtytwo Mundatawaddakuls or districts, having a Tassildar at the head of each; under him are the Sumpurdypully or the principal accountant of the district, two or three Keelcootumpully or assistant accounts; the Moodulbuddycar or cashkeeper, six or eight Seereegoonchootacurra or peons, employed in collections; two or three

31. 'The Chiefs held their lands on feudal tenure, undertaking to follow their liege lords at the head of their men to defend them whenever necessary. The Nair community formed the militia of the land, liable to be called for active service by the feudal chiefs at any moment. There were no standing armies then. K. P. Padmanabha Menon, History of Kerala, Vol. I. p. 263.

Vullathuddeecar who act as hircarra: also several Provertycars managing smaller divisions, which have each a Chundrakar or cashkeeper and accountant. The villages of which those divisions are composed have their proper officers exercising a domestic jurisdiction. There still remains a long list of various other officers employed in the collection of the pepper customs, in charge of the several Paundysaulays, which the monopolies render necessary, and the large establishment forming the Huzzoor or Dewan's Cutcherry, but their enumeration may be postponed as their duties will be inferred*.

In the year 1835, the State was divided into two Revenue Divisions, the Southern and the Northern and each Division was placed under the charge of a District Officer known as the Dewan Peishkar. In 1860 two more Revenue Divisions were constituted viz., the Quilon and the Kottayam Divisions. In 1882 Division Assistants were appointed in these Divisions. At the close of the last century there were 4 Divisions, 32 Taluks and 422 Pakuthies. There have been occasional changes since then in regard to the boundaries of the Revenue Divisions and the arrangements made for their administration. These Divisions were Padmanabhapuram, Trivandrum, Quilon and Kottayam. Kottayam division consisting an area of 3,289.01 square miles and 42 taluks was the largest among the divisions.

In 1901 the state was divided into 31 Taluks. These were grouped into 4 Districts called Divisions. The average area of a Division was 1,773 square miles and was about one third size of the then average Madras District. The Kottayam Division was the largest with 3,289 square miles. It was followed by Quilon having 2,371 square miles. The other two Divisions, Trivandrum and Padmanabhapuram extended over 817 and 613 square miles respectively. The average area of a Travancore Taluk was 228.74 square miles. Excluding the Cardamom Hills, the

* Among the most remarkable are the Dewan Peishkar, Tana Sheristadar, or head of the Police, Vullia Maliyailutu Pillay, which may be translated Accountant General, Maliyailutu Pillamars, Sumpurdy Pillamars, Keelcootum Pillamars, Geomastahs, or various ranks of Accountants, Unchull Pillamars, Post Masters: two Moodhubuddies or Treasurers for Receipts and Disbursements, &c. &c.

Chengannur Taluk (836 square miles or 11.08 per cent of the total) was the largest. The taluk of Karthikappalli with only 74 square miles (one per cent) took the last place among the taluks of the state[32]. The tract country known as the Cardamom Hills had a total extent of 972.43 square miles. Though not a district Revenue unit, it was a separate Division for magisterial and general planting purposes. In the year 1909 the 5th Division Devikulam was newly constituted out of the adjoining taluks of Kottayam Division and the Cardamom Hills. The Division measured 1,254.55 square miles or about 1/6th of the entire state was made up of Peermade and Highranges and constituted the chief forest wealth of the State. Of the administrative Divisions at the time of the Census of 1911 Quilon was the biggest being nearly twice the Cochin State, next came Kottayam. For the purpose of administration the State was divided into 5 Divisions and 33 taluks. In between the years 1911 and 1921 the number of administrative Divisions was reduced to 4 and that of the taluks to 30. The administrative Division of Padmanabhapuram was abolished and amalgamated with the Headquarter Division of Trivandrum and the combined Division was called the Southern Division. Three villages covering an area of 31 square miles were taken from the Kottayam Division and included in the Quilon Division which was named the Central Division. Six villages extending over an area of 210 square miles and which formed part of the Devikulam Division were transferred to the Kottayam Division, the name of which was changed into the Northern Division, while the reorganized Division of Devikulam was given the name of the Highrange Division. In the interval between 1921 and 1941 the territorial units underwent several change and by 1941 Census the number of administrative Divisions consisted of 3 Revenue Divisions 30 taluks and 484 Pakuthies. Of the 30 taluks, 15 taluks had been grouped into seven Revenue Sub Divisions, each in charge of an Assistant Peishkar. This was the position of the State of Travancore on the eve of the transfer of power.

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32. Census of India, 1901, Vol. XXVI—Part I— Report Page 12.

Like the other regions of Kerala Malabar was also divided into a number of small principalities or *Swaroopams*.

The *Naduvazhi or Udayavars* were independent rulers. The village was the basic unit of administration. Thomas Munro makes the following observation about these ancient political divisions.: "The *village in Malabar was called desam, the term by which it is still more commonly known. The headman was called the Desavazhi or Jenmiwar*[33]. Charles Turner reported that there was the *desam* with its ruler the *Desavazhi* and the Nadu or district with its ruler the *Naduvazhi*[34]. The *Nadu* or the *Desam* constituted many *taras* or village communities. Scattered through these *nadus* and *Desams* were the Namboothiri *gramams*, each *gramam* having its own *desam*. The following extract from the Malabar Land Tenure Committee 1885 is worthy of reproduction here: "From the documents it can be understood that the organization of the country for agrarian, civil, social and administrative purposes was closely resembling to that of Tamilnadu, the cradle of its race, language and institutions. It rested with village system. There were the *tara* and the *cherry* and later the *desam* and *ul-desam* with all its institutions of headmen (*Pathi, Desadipathi, Desavazhi* etc.) hereditary village servants (*Cheri Jenmakar)* and village panchayat or *Kuttam;* there were the *Vattams* or village circles of Tamil countries, possibly with their official organization for revenue registration and record. There probably existed in many parts of the country at least the *Kaval* system of police. In all South Indian States *Kavalkars* were appointed for each town and village and they received grains and faces for their service. There were wider religious orders and personages (Namboothiris etc.) and institutions with their usual privileges. Finally there were independent native princes with their extensive private properties and sources of public income and taxation"[35].

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33. Report to the Board of Revenue, Para 7.

34. Charles Turner, Malabar Tenancy Report, Chapter II.

35. Reports of the Malabar Land Tenure Committee appointed by G. O. September 17, 1885, No. 615, Political 1887.

General

Thus the country was divided primarily for military purposes into *desams* each under the command of a *Desavazhi* and *Nadus* under *Naduvazhis*, and secondly for civil purposes into *taras* or villages and *nadus*. Every *tara* and *nadu* was ruled by a *Kuttam* or assembly of elders (*Karanavars*). In each *tara* were certain *Taravads* or chief houses and each *taravad* house sent one male representative to the *Tara Kuttam*. The several *tara kuttams* formed the *Nattukuttam*. Another name for the members (*Karanavar* or elders) of the *Nattukuttam* was six hundred.

It is doubtful whether as Logan maintained the original *tara* was ever, an administrative unit or a territorial division. The genesis of the present village is for certain to be traced in the organisation of the several petty kingdoms of Malabar into *desams* and *nadus*. A full account of the system is to be found in the report of Sir Thomas Munro dated July 1837[36]. 'The districts *(nads)* were divided into villages *(desams)* under hereditary chiefs, whose duties making allowance for the military nature of the Government did not essentially differ from those of the district village officials of other countries. The Headman of the desam was called the desavazhi or the junmiwar (janmi) according as he enjoyed the whole or only a part of the rights which were supposed necessary to the constituting the complete chief of the desam. These rights were as follows: —

"1. The Ambalapathi or the direction of the religious ceremonies of the village pagodas.

"2. The Urayma or the management of the pagoda lands and servants.

"3. Desam or the control of marriages and all village ceremonies, more of which could be performed without his leave.

"4. Desadipathi or the general superintendence of all offences of the Desam or village.

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36. Quoted by C. A. Innes, Malabar District Gazetteer, 1951. PP.366—67.

"when the head of the village possessed all these rights he was the Desavazhi; when he wanted the ambalapathi and the Urayma, but had the other two, he was the janmi of the village. These rights where they existed could not be separated. *The direction of the civil, religions and military affairs of the* village were always vested in the same person.

"There was a Desavazhi to every village, except where the village was the private property of the chief of the district called the Naduvazhi, or of the Raja, when the rights of the head of the village belonged to the Naduvazhi or the Raja; but in most of the villages which the Rajas had acquired the property by purchase, the old desavazhis still retained their office. Where there was no desavazhi, the Raja employed an officer called Pravarthikar as the manager of one or more villages according to their size.

"The Desavazhi had the direction of all the affairs of the village; all orders regarding them were sent to him to be carried into effect. Where there was no regular land rent, he could not have much employment as a Revenue Officer; but he assisted in the collection of occasional contributions as well as of fines, forfeitures and other dues of Government. He was the military chief of the village and marched at the head of its quota when ordered to the field, and he had the direction of the Police and the power of deciding petty suits. In police and judicial matters he was aided by two or three respectable inhabitants who were called Pramanis.

"There were usually from one to five or six Pramanis to a Desom or village, but in some villages none. They had no regular appointment, nor were they hereditary. They were of all the superior castes—Nambudiris, Nayars, Tiyars, Chettis and Mappilas— but chiefly Nayars; any respectable man in the village who was considered as more intelligent than his neighbours, and who was on that account resorted to by the inhabitants for the adjustment of their little differences, gradually acquired among them the little of Pramani..........The Desavazhi had no village curnam, the nature of the revenue did not require an officer of that kind. The accounts of the collections were

kept by District servants, employed by the Naduvazhi or acting immediately under the Raja. He had none of the inferior village servants, such as Peons, Thottis and Taliaris, so common in the other provinces. The office next above the Desavazhi, and places between him and the Raja, was the Naduvazhi or the chief of the Nad or District. He was a kind of District Desavazhi in the village. He claimed to hold his office by a tenure as ancient as that of any of the present Rajas, and to have derived it from the Nambudiri Brahmans or from the same former conqueror, from whom they derived their rights. He was sometimes the Desavazhi of every village in his district, and sometimes of only one or two, the rest being held by Desavazhis or by the Rajah as part of his domains.

"The Naduvazhi collected the ordinary and extra revenue, and in this duty he was assisted by one, two or more accountants called Putwallis. The Naduvazhi was the military chief of his district and was bound to attend the Raja in the field, or march wherever he was directed, with all the fighting men of his district under the desavazhis or heads of their respective villages".

During the Mysorean interregnum, the semi military organisations of *desams* and *nads* were abolished and *subahdars* and *faujdars* took the place of the Rajas and *Naduvazhis*. The village system was re-structured. The author of the District Gazetteer of Malabar, Innes, described the system: "Small villages yielding a revenue of only ten to twenty or fifty pagodas, when lying contiguous, were joined together to make a sum of two hundred pagodas, and the whole was called a tarrah (tara) which took the name of the principal village. From forty to eighty tarrahs were joined into a *Nad* or District. To each tarrah a Parbutti and menwa (menon) or curnam was appointed, and to each district a Tahsildar and two Sheristadars. In each village it was ascertained who were the leading men exclusive of the former Desavazhis, and one of these was appointed head of the village and called the "*Mookhyist*".

Subsequently as the men first appointed as *Mookhyists* died, the *desavazhis* being the most influential men in the

villages gradually regained their former position, and became *Mookhyists*. The collection of the revenue was the duty of the Parbutti; the Mookhyist only assisted and advised him.

The report of the Joint Commission of the Province of Malabar in the years 1792 and 1793 enumerates the principalities into which Malabar was divided as given in Annexure. The revenue unit was enlarged into the hobily and the number of Parbuttis reduced. One Parbutti had to collect the revenue of twenty villages. The *amsam* system as existed during the eve of the formation of Kerala was the result of the report of Graeme, Special Commissioner in Malabar from 1818 to 1822. He introduced the new system of Police and Magistracy; he re-organised the village establishment and in 1822 he submitted his voluminous report suggesting improvements in administration[37]. Mr. Graeme grouped the 2212 old *desams* into 429 *amsoms* each under a headman or *adhikari*.

With the establishment of British Supremacy in Malabar, it was divided into six divisions and 10 taluks for purpose of administration. The northern most taluks on the coast Chirakkal, Kottayam and Kurumbranad—formed the Tellicherry Division, the Wynad and Calicut taluk each constituted a division in itself, Eranad Taluk which stretched from the borders of Nilgiri district to the sea—and the inner taluk to the south of it Valluvanad formed the Malappuram Division and the Palghat Division included in the two taluks in the South—Palghat and Ponnani. British Cochin was also considered as a Division, even though its extent was similar to that of a village or *Pakuti*. The headman of an *amsom* was called an *Adhikari* and his Accountant *Menon*. By 1907 there were 673 *amsoms* in the erstwhile Malabar district. A *desoms* was a sub division of an *amsom*. Malabar district contained 285 *desam* The *desam* was taken as the unit of Survey and settlement and separate revenue accounts were maintained for each[38].

There were permutations and combinations in the number of *amsoms*.

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37. Madras. 1882.

38. The 5th tour of Arthur Lawley, Governor of Madras to Malabar dated September 13th to 24th, 1907.

General

The revenue administration of the district was controlled by the Collector aided by the Sub-Collectors or Deputy Collectors at Tellicherry, Palghat, Malappuram, Calicut and Cochin. The Collectors were known by different appellations as Commissioners, Supervisors, Principal Collectors etc. The Wynad Division was abolished in the year 1924 and Wynad taluk was added on to the Tellicherry Division from which Kurumbranad taluk was detached and added on to Calicut. There was a Tahsildar in each taluk except Cochin and each Tahsildar was assisted by a Deputy Tahsildar. There were 9 taluks in 1924 viz., Chirakkal, Kottayam, Kurumbranad, Calicut, Wynad, Eranad, Walluvanad, Ponnani and Palghat. Cochin taluk which was also a part of the district included the town of British Cochin and 17 isolated estates situated within the boundaries of Cochin State. The Laccadives island of the coast were also administered by the Collector.

On the eve of the formation of Kerala the Malabar district was having 11 Taluks viz., Chirakkal, Kottayam, Wynad, Kurumbranad, Kozhikode, Laccadives Minicoy and Androth island, Ernad, Walluvand, Ponnani, Palghat and British Cochin with 1495 villages and 14 towns. As a result of State Reorganisation the whole of Malabar district were transferred to Kerala. The Laccadive Minicoy and Androth Islands which were under the administrative control of the Collector of Malabar were transferred to the control of the Central Government with effect from November 1, 1956. From November 1, 1956 the former Malabar District and the Kasaragod Taluk of the South Kanara District were called the Malabar area of the State and this area was considered as a single District for administrative purpose and was under the control of the Collector of Malabar with Headquarters at Kozhikode. On January 1, 1957 the then Malabar District was trifurcated into the districts of Cannanore, Kozhikode and Palghat. New Revenue Divisions were formed at Kasaragod in the Cannanore District and Ottapalam in the Palghat District. Thus the Malabar area of the State was divided into three districts, each district comprising of two divisions. Some of the bigger taluks in the area were bifurcated. Hence there were 18 taluks including Fort Cochin. Another change that was effected by the trifurcation of the Malabar area is that Fort Cochin and the Chowghat taluk became part of the Trichur

District and the Chittoor Taluk of the Trichur District was added to the Palghat District.

Cochin

Like the State of Travancore, the early history of Cochin is also burried in the tangled skein of obscurity. According to tradition, the Raja of Cochin claimed to hold the territory in the right of descent from Cheraman Perumal who governed the whole country of Kerala including Travancore and Malabar. It is believed that the Central portion of the country extending from Ponnani to Etumanur and from the Ghats to the sea formed the Cochin State. The dynasty that ruled was called *Perumpadappu Swarupam* and the land over which he held his sway was called *Perumpadappu* country. The *Perumpadappu Mooppil* as the Cochin Raja was called, had originally his headquarters at Mahodayapuram, which was the imperial capital of Kerala during the Kulasekhara epoch. This is clear from the copper-plate grant of 1225 A. D. of Veera Raghava Chakravarthi to Iravikorthan from Perumkovilakom in Makotairpattinam. Till the beginning of the 15th century Mahodayapuram continued to be the headquarters of the *Perumpadappu Swaroopam*. Certain geographical and political factors brought about the shifting of the capital from Mahodayapuram to Cochin. In 1341 Cranganore harbour became silted up by the heavy floods which took place in the Periyar river and Cranganore declined in importance as a port. Also the aggressive activities of the Zamorin of Calicut led to the shifting of the capital from Mahodayapuram to Cochin. This might have taken place in about 1405 A. D. In later periods of its history other places like Njarakkal, Udayamperoor, Palluruthy, Vellarappally and Tripunithura also served as the capital of *Perumpadappu Swaroopam*. It is stated in the Cochin State Manual that in about 1500 A. D. the kingdom of Cochin comprised approximately 10,360 sq. km. of territory which included practically the whole of the present Trichur district with the exception of Cranganore and parts of Chavakkad taluk and the whole of the present Ernakulam district and portions of Palghat, Kottayam and Alleppey districts. The contention of the author of the Cochin State Manual is not true to facts as revealed from the remarks of Durate Barbosa who wrote in 1550 that Cochin was only a petty principality and that its ruler was not even a king in the real sense of the term. He had remarked that the ruler owned only Cochin and adjoining

areas and Thiruvanchikulam. But by the end of the 16th century Cochin acquired more territories with the help of the Portuguese. The king was the supreme ruler of the country. Like the rest of Kerala the kingdom was divided into a number of Nadus or districts each of which was presided over by a *Naduvazhi*. Each *Nadu* was divided into *desoms*. The *desoms* was further sub-divided not into territorial unit but into caste or tribal groups such as the *gramam* of the Nampoothiris, the *tara* of the Nayars and the *Chery of the low castes*. The *'Five Hundred'* of Kodakaranad *Four Hundred* of Annamanadai the *Three Hundred* of Changazhinad were important of the *taras* of the Cochin State. The *desavazhis* were in full charge of the affairs of the *desam* and were responsible for the execution of all the orders of the king or the Naduvazhi. In 1759 the Raja was attacked by the Zamorin of Calicut who was expelled by the Raja of Travancore and as a reward for the service, certain portions of his territory viz., Parur and Alangad were transferred to Travancore in 1761. After the treaty of 1761 with Travancore Kerala Varma (1760-1775) introduced a new system of administration in the State. The State till then divided into *nadus* were renamed *Kovilakathumvathukal* or taluks each of which was placed under a *Karyakar* who exercised both judicial and executive functions. There were 10 such *Kovilakathumvathukals* or taluks during the time of Kerala Varma. The taluks were further sub-divided into *pravartis* which formed the units of administration. They were presided over by *Pravartikarans* assisted by *Menons* or accountants and *Chandrakarans* or cash keepers. The taluks were grouped into two divisions; the *Vadakkemukham* and the *Thekkemukham* or the Northern and the Southern divisions each under a *Sarvadhikaryakar*, the head of the administration being vested in the *Valia Sarvadhikaryakar* or prime minister. The present Trichur District formed part of the *Vadakkemukham* or Northern division and the major portion of the present Ernakulam District formed the *Thekkemukham* or the Southern Division. Till 1860 the State consisted of ten Taluks or *Kovilakathumvathukals* and 648 villages. These were Cochin, Kanayannur, Cranganore, Mukundapuram, Kodaseri, Talappilli, Chelakkara, Enamakkal, Trichur and Chittur. In 1860 there was the reorganisation of Taluks as a result of which certain taluks were

grouped together. Cochin and Kanayannur were amalgamated into one Taluk viz., Cochin-Kanayannur, Chelakkara amalgamated with Talappilli, Kodasseri with Mukundapuram, and Enamakkal with Trichur. Thus the number of Taluks in the State was reduced from ten to six, and at the time of the integration of Travancore and Cochin the latter consisted of six Taluks, namely, Cochin-Kanayannur, Crangannore, Mukundapuram, Trichur, Talappilli and Chittur. These six taluks, together with Kunnathunad and Parur Taluks which were till then attached to Kottayam District, were constituted into the new District of Trichur from July 1, 1949 viz., the date of the inauguration of the United State of Travancore-Cochin. This newly constituted Trichur District continued without any change till September 30, 1956.

Independence and after

With the attainment of freedom and independence under responsible government the movement for a united (Aikya) Kerala gained a momentum. A series of conventions were held pressing for the formation of the Kerala State. The first step in this direction was the integration of the States of Cochin and Travancore under a Raja Pramukh. The rulers of Travancore and Cochin entered into a covenant on July 1, 1949, by which the two rulers transferred their rights, authority and jurisdiction to the new State called the United State of Travancore and Cochin. It envisaged a Raja Pramukh as the head of the United State and the ruler of Travancore to be the first Raja Pramukh of the United State for life. The executive power was vested in the Raja Pramukh who would be aided and advised by a council of ministers. The Raja Pramukh executed an instrument of accession under section 6 of the Constitution of India Act 1935, accepting the federal supremacy of the dominion legislature.

The total area of Travancore was divided into three districts viz., Trivandrum, Quilon and Kottayam. The State of Cochin with its area of 3,833 sq.km. had no districts. But it was divided into six taluks viz., Cochin, Kanayannur, Crangannore, Mukundapuram, Trichur, Talappali and Chittur. As Cochin was much smaller than a district of Travancore, two northernmost taluks of Travancore, Paravoor with an area of 200 sq.kms. and a population of 168,200 and Kunnathunad with an area of 484 sq.kms. and a population of 186,899 were merged with it in

order to attain territorial unity and administrative economy. Thus the Trichur District emerged out of the erstwhile Cochin State as one of the four districts of the United State of Travancore—Cochin.

There was no change in the areas of the two States between 1941 and July, 1949. The area of the integrated State was almost unaffected by the territorial changes which accompanied the coming into force of the Constitution of the Indian Republic. Under the Provinces and States (Absorption of Enclaves) Order 1950, a few bits of territory were added to the State of Travancore—Cochin from Madras and a few enclaves were surrendered to Madras, with effect from January 25, 1950. The additions (the chief of which were Anjengo in the Trivandrum district and Tangasseri in the Quilon district) amounted to 643 acres and the loss to 360 acres; the loss was all from the Trichur district.

The next stage of political integration for the evolution of Kerala had begun with the appointment of the States Re-organisation Commission. On the basis of the report of the Commission it was decided to add the Malabar district and the Kasaragod Taluk of South Canara district to Travancore—Cochin and to separate the Tamil speaking southern region of old Travancore from Travancore—Cochin for inclusion in the Tamilnad. The four Tamil speaking taluks, formed part of the territory of Venad, which was the matrix of the history of Travancore. The four southern taluks with an area of 646 sq.kms. and a population of 829,980 and a portion of the Shenkottah taluk measuring approximately 294.9 sq.kms. were transferred to the State of Madras. The details of the transferred taluks of the south Travancore are given below:-

Details of transferred taluks of South Travancore

Taluk	Area in. sq. kms.	Population	Density
Thovala	370	52,980	372
Agastheeswaram	277	225,405	2,105
Kalkulam	593	287,159	1,254
Vilavancode	433	264,076	1,563
Total :	1,673	829,980	

The State Re-organisation Act envisaged in return the merger of the Malabar district comprising an area of sq. kms. and Kasaragod taluk of South Canara having an area of 502 sq. kms. with Travancore. The Laccadive and Minicoy Islands of the old Malabar district were not transferred to Cochin to form the Malayalam speaking State of Kerala. on November 1, 1956 the new State of Kerala came into being regaining the identity of the land of Parasurama of the hoary past[39] Thus when the bells tolled on November 1, 1956 ringing the new State of Kerala, it was composed of three territorial units; the erstwhile princely States of Travancore and Cochin (known as the United States of Travancore-Cochin) and the district of Malabar which was a part of the composite Madras State. Among the three, Travancore was the largest having an area of 21,748.75 sq. kms. as against 3,833.2 sq. kms. of Cochin and 14,403 sq. kms. of Malabar.

On January 1, 1957, three new districts namely Palghat Kozhikode and Cannanore were carved out of the old district of Malabar. Kasaragod transferred to Kerala from the South Canara District of the erstwhile Mysore formed the northernmost taluk of Cannanore district. The Palghat district thus formed consisted of old Walluvanad, Palghat and portions of Ponnani taluks of Malabar district and Chittur taluk of the erstwhile Travancore—Cochin State. On the same date the old Walluvanad taluk was bifurcated into Perinthalmanna and Ottappalam taluks while Palghat taluk was bifurcated to form Palghat, Alathur and portion of Chittur taluk. The present Chittur taluk is formed by taking the entire Chittur taluk of the former Travancore—Cochin State and 14 villages of the old Palghat taluk. The old Ponnani taluk was divided into three forming the existing Ponnani taluk, the Chowghat taluk and portion of Tirur taluk. Chowghat taluk and portion of Tirur taluk were included in the Trichur and Kozhikode districts respectively on the same date.

The Kozhikode district formed on January 1, 1957 consisted of Badagara and Quilandy taluks formed out of the old Kurumbranad taluk on this date, the Kozhikode taluk, the Ernad taluk (i. e., residury portion of the old Ernad taluk left after

39. See Appendix I[1] to the Chapter.

taking a portion to the Tirur taluk) and the Tirur taluk newly formed on this date taking in a portion of the old Ernad taluk and the old Ponnani taluk. On March 15, 1957 the South Wynad taluk was transferred from the Cannanore district to this district.

The Cannanore, the northernmost of the districts of Kerala was formed with Cannanore, Hosdurg, Kasaragod, Kottayam, North Wynad, South Wynad and Taliparamba taluks. Kottayam taluk was since then renamed Tellicherry. The inclusion of South Wynad in the new district of Cannanore was only a temporary arrangement. After the General Elections of 1957 it was included in the Kozhikode district with effect from March 15, 1957. There were six taluks in the Cannanore district viz., Kasaragod, Hosdurg, Taliparamba, Cannanore, Tellicherry and North Wynad. Thus the Malabar area of the State was divided into three districts and each district into two divisions. New Revenue Divisions were formed at Kasaragod in the Cannanore district and Ottappalam in the Palghat district. Some of the big taluks in the area were bifurcated. Hence there were 18 taluks whereas prior to January 1, 1957, there were only 12 taluks including Fort Cochin. Another change that was brought about by the trifurcation of the Malabar area is that Fort Cochin and the Chowghat taluk became part of the Trichur district and the Chittoor taluk of the Trichur district was added to the Palghat district.

There were protests in some parts of Malabar against the formation of the new districts without taking into consideration their proximity to the district headquarters and this led to the separation of the Chowghat revenue firka of Chowghat sub-taluk from Palghat to Trichur, and the transfer of Pookode, Perakam, Iringapuram, Kadappuram, Manathala from the Ponnani taluk of the Trichur district.

On August 17, 1957 the district of Quilon was bifurcated as it had become unwieldy for administrative reasons'. Thus the new district of Alleppey emerged on the map of Kerala with the taluk of Shertallai, Ambalapuzha, Karthikappally, Tiruvalla and Mavelikara of the Quilon district and the rice-rich Kuttanad from the Kottayam district with the town of Alleppey as its

headquarters. Subsequently two new taluks viz., Kuttanad and Chengannoor were formed. The district consisted of two Revenue Divisions Alleppey and Chengannoor.

Again on April 1, 1958 a new district by name Ernakulam was carved out of the erstwhile Trichur and Kottayam districts with headquarters at Ernakulam for administrative convenience. It comprised of the taluks of Alwaye, Parur, Kunnathunad, Kanayannur and Cochin of the Trichur district and Moovattupuzha and Thodupuzha of the Kottayam district. The district was divided into two administrative sub-divisions, one for the eastern portions with its headquarters at Moovattupuzha and the other at Fort Cochin. Consequent on the formation of Idukki district a new taluk by name Kothamangalam was constituted in the district from January 26, 1972 comprising Kuttamangalam, Keerampara, Kothamangalam, Pindimana, Kottapady, Eramalloor, Varapetty, Kadavur, and Pothanicadu villages of the Moovattupuzha taluk and Malloorkkad village of the Thodupuzha taluk.

The nine districts of the State continued without any change till June 16, 1969 on which date a new district named Malappuram came into being with headquarters at Malappuram, thus raising the total number of revenue districts to 10. The district was constituted comprising the entire Ernad taluk and Tirur taluk (excluding the villages of Feroke, Ramanattukara, Kadalundi and Parudur) of the erstwhile Kozhikode district and part of Perintalmanna taluk (consisting of Mankada firka and Perintalmanna firka excluding Karkitamkunnu and Chettallur amsoms) and Ponnani taluk (excluding Thrithala firka and the villages of Vadakkekad, Punnayur and Punnayurkulam) of the erstwhile Palghat district. The district consists of four taluks viz., Ernad, Perintalmanna, Tirur and Ponnani.

On January 26, 1972 the eleventh district of the State was formed. The Idukki district as it is called consists of the entire Devicolam, Udumbanchola and Peermade taluks of the erstwhile Kottayam district and Thodupuzha taluk (excluding the entire Kalloorkad village and portion of Manjalloor village)of the old Ernakulam district. Thus the district has 4 taluks. Its headquarters is at Painavu.

General

The Changes in jurisdiction at the district level in the State in between the years 1971—1981 are given hereunder: (1) silent valley Reserve Forest area in Karuvarakundu village of Ernad taluk of the Malappuram district was transferred to Mannarghat taluk of Palghat district on August 17, 1976 and (2) North Wyenad taluk of Cannanore district was transferred to Kozhikode district on January 1, 1979.

The twelfth district in the state viz. Wynad was formed on November 1, 1980 comprising of the taluks of North Wynad and South Wynad. The two Wynads were in two districts situated away from the district headquarters and there was a feeling that the problems of Wynad were not being tackled properly at the appropriate levels. North Wynad taluk formed part of the district of Cannanore till January 1, 1979 and South Wynad that of the district of Kozhikode till November 1, 1980. The people of Wynad desired the formation of an exclusive district for Wynad to ensure the development of the area. In 1974, the Government therefore considered the constitution of a development authority for Wynad and appointed a Special Officer for Wynad Development. A Deputy Collector for Wynad Development was appointed for implementing the Wynad development programme with his headquarters at Kalpetta. Subsequently with the formation of a separate Revenue Division for Wynad, the establishment of the Deputy Collector for Wynad development was abolished and the new Revenue Division was entrusted with his work. But sadly enough although a number of schemes have been identified and a few schemes implemented, not much headway could be made in meeting the requirements of the people under this arrangement. Ultimately Government decided to constitute a separate district considering the backwardness of the area and the demand of the people. Consequent on the formation of Wynad district, the North Wynad taluk was renamed Mananthavady taluk and South Wynad was split into Sultan's Battery and Vythiri taluks. This least populous hill district of the State has an area of 2,125.67 sq.kms. with headquarters at Kalpetta and comprising of three taluks.

On November 1, 1982 Government announced the formation of a new Revenue District Pathanamthitta with headquarters at

Pathanamthitta. The formation of the district was taken up in view of the unwieldy nature of the Quilon district for purposes of administration. Quilon was the largest district in Kerala before the formation of the district of Pathanamthitta. The distance from the eastern border to the district headquarters of Quilon was over 170 kms. while the western areas of the district were mainly plantation areas, the eastern regions were mainly agricultural. The unwieldiness and diverse geographical features of the district retarded the progress and development of certain areas especially the eastern parts of the District. In the eastern forest land of the District, a vast area exceeding those of two taluks was set apart for those who were evicted from the Idukki Hydro-electric Project area as also political sufferers, educated un-employed, ex-servicemen, Harijans and hill tribes. In order to provide them with the basic amenities of life and to develop the area economically and culturally, the formation of a new viable district capable of meeting the needs of these people was imperative. The demand for a new district was in vogue for the past several years gained momentum when a committee viz., District Formation Committee was constituted for the same. Subsequently Government appointed a Special Officer for the formation of Pathanamthitta district. On the basis of the report of the Special Officer, Pathanamthitta district was carved out of the erstwhile Quilon and Alleppey districts and the new district came into existence when it was formally inaugurated on June 30, 1983.

The District has an area of 2,672 sq.kms. with a population of 11.37 lakhs. Of this area 1,412 sq.kms. form forest land. 21 Villages in the Pathanamthitta taluk, 9 villages of the Kunnathur taluk of the Quilon district, 18 villages of the Tiruvalla taluk and 2 villages of the Mavelikkara taluk of the Alleppey district were grouped to form the new district. The area known as North Pamba Valley and the land around Sabarimala Sannidanam in Mlappra village of Peermade taluk of Idukki district were added to the new Ranny Village of the district. The district consists of five taluks—Kozhencherry with headquarters at Pathanamthitta, Ranny with headquarters at Ranni, Adoor with headquarters at Adoor, Tiruvalla with headquarters at Tiruvalla and Mallappally with headquarters at Mallappally. There are two Revenue

Divisions in the district viz., Adoor having jurisdiction over **Kozhencherry** and Adoor taluks and Tiruvalla over Tiruvalla **Mallappally** and Ranny taluks respectively.

Kasaragod: The fourteenth district of the State. Kasaragod came into being on May 24, 1984.* The formation of the district comprising the State's northern-most taluks of Hosdurg and Kasaragod in the Cannanore district is intended to bring an under-developed region within the easy reach of a new administrative tenor and to meet the neglected economic needs of the region.

Before their inclusion in Kerala, consequent on linguistic reorganisation of States in 1956, Hosdurg and Kasaragod taluks were part of old South Canara which belonged to the then Madras State. These regions which were known as Bakel Taluk till then were renamed Kasaragod taluk in 1862. It was in the same year that South Canara was separated from the Bombay Presidency and merged with the Madras State. Since then the popular demand for merging Kasaragod with the Malabar district was gaining momentum. From time to time various resolutions were passed by local organisations and a number of movements were organised to get this demand conceded. Soon after the linguistic reorganisation and the formation of Kerala, Kasaragod taluk was bifurcated into Kasaragod and Hosdurg taluks on January 1, 1957. However, the condition of this traditionally backward region remained the same even under the reorganised set up. Convinced of the economic backwardness of this region, Government of Kerala appointed a Commission in 1971 to study and report on the developmental needs of Hosdurg and Kasaragod taluks. On the basis of the Commission's Report a Development Authority was constituted in 1980 envisaging the overall developmental needs of these taluks and the new administrative entity is a realization of the distinctive social and economic mosaic.

With its water, forest and mineral resources, the new District is flanked by the protective cover of the Western Ghats in the East and the Arabian Sea in the West and demarcated by

* Notification G.O. (MS) No. 520/84/RD dated May 19, 1984.

the silver glaze of Talapadi river in the North and Thrikaripur river in the South. Scars of grey rocks and barren lands embedded in dense vegetation and the gleaming lagoons which are visible beyond the terrace of coconut trees along the coastal belt endow the region with a rich and beautiful panorama.

The Kasaragod district has an area of 1984 sq. kms. and a population of 8,71309. It has its headquarters at Kasaragod Municipal town. Thaliparamba taluk in Cannanore district in the Kasaragod Revenue Division was transferred to Tellicherry Revenue Division in Cannanore district.

Revenue Divisions, Taluks and Villages in the 14 districts of the State are given in Appendix vii.

PHYSIOGRAPHY

General

The earliest geographical descriptions of Kerala in extant are found in the writings of the Greek and Roman geographers. These works give compact and comprehensive accounts of the ports of Kerala and their trade with Mediterranean world. A later account of India which can be regarded as perhaps the last Greeco—Roman account dealing with South India is the record of the visit of Cosmos Indicopleustes to the Malabar Coast. This work attempts to disprove the theories of classical geography on the conformation of the earth and to establish notions such as a flat earth as the centre of the universe, about which the sun and the planets revolved.

The Sangam literature of the early centuries of the Christian Era contain the earliest indigenous geographical description of the area. The landscape was classified into five types each presided over by a deity and named for a flower or tree characteristic of the region. In the Sangam literature the actual objective landscapes of the country became the interior landscapes of poetry. The five fold classification reflects an appraisal of the important settings in which the men of South India lived at the time. The Sangam literature, and the later Tamil, Kanarese, Telugu and Malayalam literature, contain many references to places, people and activities, but little of this material can in any way be construed as specifically geographical. Certain pieces of work composed in South India were however more specifically geographical. For example, following the example of Kalidasa many poets of Malabar composed what are known as *Sandesa Kavya* which describe the geography of the different kingdoms into which Malabar was divided in historic times. Most of these works date to the thirteenth century. Until the end of the eighteenth century most of the writings which are directly concerned with descriptions of places in South India (as opposed to basic source materials for use in research were the products of Chinese travellers, Muslim geographers and travellers, and European travellers and officials. The Chinese

descriptions of South India are somewhat limited in extent, since only one of the noted pilgrims, Hiuen Tsang, actually travelled through the area. The works of the Muslim geographers and travellers are much more comprehensive and were actually carried out as pieces of geographical work. During the eighth and following centuries new zest for learning spread throughout the world of Islam. The most remarkable traveller and writer was Ibn Batuta (1304—1368) whose voyages extended east as far as northern China and South along the east coast of Africa. Other Muslim geographers who mention South India include Al Beruni, Al Idrisi, Ibn Khaldun and Abd-er-Razzak. The first post—classical European mention of South India is in the writings of Marco Polo who returned to the Mediterranean World via. southern and western India in the late thirteenth century. The greatest number of early European travellers accounts which describe places in South India date to sixteenth and seventeenth centuries. In the sixteenth century with the establishment of Portuguese settlements on the western and south eastern coasts the number of descriptive accounts of parts of South India greatly increased. Besides these accounts, by the late eighteenth century large bodies of official records and other materials were being generated by the European trading companies with outposts in South India. This increase in knowledge is also reflected in the growing amount of detail and accuracy of maps from the early sixteenth to early eighteenth centuries.

In the eighteenth century with the territorial struggles in South India between the Marathas, Hyderabad, Mysore, the British and the French the need of the latter groups for detailed maps and descriptions of places expanded, of particular interest are detailed descriptions of routes, points of interest, and conditions in the areas in contention between the powers. After 1750, the British produced the largest volume of descriptive materials on the geography of South India. One work deserves special mention as undoubtedly the most comprehensive description of a large portion of South India viz. Francis Buchanan's "Journey from Madras through the Countries of Mysore, Canara and Malabar (Vol. I—III 1st ed. Madras 1807). Another body of truly geographical materials were those generated

by the Surveys initiated by the East India Company to establish a better knowledge of the land and people. Each of the survey parties, and often individual surveyors, compiled detailed memoirs of their survey. The memoirs were prepared by men who had considerable knowledge of the areas where they worked, and they often contain insights into South Indian life found nowhere else, the most outstanding among them being: The Memoir of the Surveys of Travancore and Cochin by Ward and Conner in 1816. This tradition of producing accounts describing areas continued in the nineteenth century and reached its culmination in the publication of the manuals and Gazetteers after the middle part of the century. After 1850, the volume of travellers accounts and personal memoirs expanded greatly. Geography as informal description of place has a long history in relationship to South India. This tradition continues to be present in publications such as the Gazetteers, travel books, and magazine and news paper articles.

The Kerala region comprises of a narrow strip of land with a total area of 39,000 km² extending between north latitudes 8°04' and 12°44' and E. longitudes 74°54' and 77°12' and is bounded by the Western Ghats on the east and the Lakshadweep sea on the west. Physiographically the region presents varied landforms resulting through complex Geological processes. From the fact that Geological formations of all the ages possiblehave not been represented in Kerala it may rightly be inferred that the region have been subjected to prolonged periods of erosion and non—deposition. As per the Public Works Department of Kerala, three physiographic zones may be identified in the state viz. (I) the Highland above 76 m. (II) the Midland, 7.6 to 76 m. and (III) the Low land below 7.6 m. Although the entire region may be conceived as a totality of forty four river basins, it is convenient to effect a division of the area into four physiographic provinces viz. the Highlands ranging in altitude from 600 m. to 2500 m. the Midlands from 300 m. to 600 m. the Lowlands from 30 m. to 300 m. and the Coastal plain with lagoons and sand dunes. The altitude range is asymmetric with the maximum area of about 24,000 sq. km. falling within an elevation of 300 m. from the mean sea level. This feature may be attributed to the occurrence of isolated hillocks numerous in the lowland, which

may be considered as the relict forms of hill ranges, originally branching from the Western Ghats and extending upto the shore line or beyond.

I. High lands :

The most prominent physiographic province in the state is the High lands comprising of part of Western Ghats, the most prominent Orographic feature of the peninsular India. The Western Ghats runs south from Tapti River to Kanyakumari as a continuous range fringing the western shore line of India. The Nilgiri, the Anamalai, Palni and the low Varshanad-Andipatti ranges with arcuate projections extending eastward into the Southern plains of Tamilnadu constitute the Ghat section within Kerala. The highest peak in Western ghats, the Anamudi (2,817.06 m) is situated within Kerala. From the extreme north the ranges run parallel to the coast at a distnce or 12 km. far as Vevalmalai to the east of Calicut. Here they turn sharply eastward, bends northward and then recede inward upto Vedamalai north of Palghat gap. South of the gap the ranges again attain lofty heights in the Tenmalai region and gradually swell into the Cardamom hill region, which is also known as High Ranges. The Ghat section in this region appears in the shape of an amphitheatre. Inspite of this general trend, various peaks are seen to take characteristic configuration either individually or in association with nearby ones. Inter-woven with numerous platforms and twisting valleys, the ranges generally rise to elevations above 2000 m. Although the hills individually rise abruptly with steep sides and the whole region is dissected by deep and narrow valleys, the general picture appears to be of numerous mounts rising from a plateau like platform. There are fourteen peaks of elevation above 2,000 m. the highest among these being Anamudi which is the highest peak in India next to those in Himalayas. The physiography of High Ranges presents a succession of lofty hills of varying elevation separated by deep valleys and several small plateaus.

The Western Ghats and the adjoining upland terrains are extensive and continuous except for the prominent break in the Palghat area. This Gap—the Palghat gap about 30 km. in width and of 80 km. extend East-West is the only major breach

within the Western Ghats. The gap connecting the West coast with the Peninsular regions in the east is bounded either side by lofty hills of 1,100 m. to 2,000 m. in elevation. The elevation in the Gap ranges from 20 m. to 100 m. Another minor breach is in the Ariyankav region which gives access to Tamilnadu by road and rail. The rail line however passes through several tunnels, the longest among which is about 1.2 km. in length.

There are various narrow gaps providing East-West access in the High Ranges also. The southern most of these connects Kumili in Kerala to Kumbam in Tamilnadu. Another one to the north at Kambammedu connects Udumbanchola to Tamilnadu. The pass connecting Tevaram to Cardamom hills is rarely used due to steepness of the route. The northernmost pass connecting Munnar to Bodinaickannur is an established trade route.

The Wynad plateau to the South of Nilgiri hills at 900—950 m. with a general slope towards East and North East forms part of the most extensive land Systems in India. It merges with the Mysore Plateau in the north. The Plateau is delimited on the west by a long escarpment. This region might have been uplifted by stages from great depth as evidenced by their hyper-granulite facies character (Radhakrishna, 1968). The postulated faulting of the Western Ghats in mid-miocene (Krishnan, 1961) also might have affected the Wynad surface in a major way. The linear hillock of magnetite quartzite at Pandalur and Devala and granitic domes around Kalpetta and Tovarimalai may be identified as erosion outlier of the Wynad surface (Parthasaradhi & Vaidyanathan, 1974).

A section of the Western Ghats is seen to extend through Thodupuzha upto the eastern margin of Alwaye taluk. The rugged hilly terrain alters itself with terrace type platforms westward, interspersed with narrow valleys. Even after merger with the midland region at about an elevation of 300 m. the succession of hills continue westward into small hillocks highly worn-down by erosion. The whole of Thodupuzha taluk is above 300 m. in elevation and hills of 900 m. or more are not uncommon. The slopes gradually recede from steep to gentle and to undulating nature.

There are evidences of polycyclic development of plantation surfaces in Kerala. Parthasaradhi and Vaidyanadhan (1974) have identified two Geomorphological surfaces in the Kerala region adjoining the Nilgiri surface, viz. the Wynad surface at 900–950 m. and the Malabar surface at about 75 m. According to Demongeot (1975), there are only two surfaces in the Palghat area of Kerala, the upper one sloping from 350 m. at the Palghat gap upto 75 m. towards the coast with a lateritic cover and the lower one representing the present coastal plains.

Tirugnanasambandam (1976) recognizes five erosional surfaces in central Kerala with distinct altitudinal ranges from 550 m. at the top to 15–17 m. at the lowest. Five surfaces have been recognized (Murthy, et al, 1976) at 1500 m. 600–900 m. 330–390 m. 150–210 m. and 60–120 m. on a regional scale. In confirmity with the above Sinha Roy (1979) identified four surfaces at 1200–1300 m, 150–200 m. 60–100 m. and 20–50 m. These surfaces have variable angle of slope towards west and their hinge zone is located roughly in the coastal strip. The existence of such a hinge zone indicates that the onshore areas of this region has undergone periodic uplift, that are punctuated by phases of erosion.

The Western Ghat region in general presents a succession of buffs. ridges and conical peaks and is of irregular and rugged topography. Most of the lofty, steep-sloped hills stand isolated, detached by low valleys. The elevation of the hills gradually decrease toward the west. Small platforms occurring among these hills may be considered as saddles in the original chains, shaped into the present form through age-old erosion.

The detailed list of peaks of significant elevation in the Western Ghat region is given in table 1.

Mid land: From the main range of the Ghat, rocky spurs run out towards the west, in most cases extending almost to a short distance from the sea shore. From Kallada river southward, these secondary ranges soften down into undulating slopes intersected by glens and valleys which grow wider as the elevation of the hills decrease and are very productive. North

of the Cardamom hills, excepting the Palghat gap area, the long spurs and extensive ravines of the Ghat mountains are seen to merge westward into gentler slopes, rolling downs and gradually widening valleys which end themselves abruptly in cliffs giving way to lowlands. Owing to the fringing mountains in the east, numerous streams and rivers flow westward in winding courses thereby hollowing out long valleys for themselves. This region of undulating topography, ranging in elevation between 300 m. and 600 m. is termed the Mid lands. The region is exclusively under laterite cover.

The Low Land: The Low Land ranging from 30 m. to 300 m. is a surface of erosion (Peneplain) dissected by numerous streams and rivers, flood plains, rockcut terraces, cut and fill terrace and colluvium 20 to 100 km in width, this region of differential relief shows a gradient of 6 to 10° from North to South. It will be of interest to note that the direction of the present day rivers is at right angles to the general slope of the peneplain. (Thiaga-Rajan, 1980).

Coastal Plain: The coastal plain is an extensively vast plain with low relief. Most of the area shows a relief of 4 to 6 m above the present day sea-level. A characteristic feature of the coastal plain is the existence of numerous beach dune ridges trending roughly parallel to the present shore line, following the general trend of the strand plain. This strand plain is covered with extensive marshy areas and lagoons. In fact the marshes and the lagoons exist in the depressions between the abandoned beach dune ridges. The strand plain averages about 10 km. in width for the entire length and is widest in the central part. The maximum width between the oldest ridge and the youngest one close to the present shore line is 18 km. Another peculiar feature of the coastal plain is that it is furrowed across by numerous sub-parallel rock ridges; many of which are partly covered by the sea. The sandy body is continuous between the ridges and all the way across the strand plain, except for the areas under kayals and marshes. It may rightly be assumed that the sand is continuing under these features even. The depressions between the ridges contain lenses of modern alluvium, inter-mixed with marine sand. Most of the rivers in this area discharge into the kayals at present.

The bore hole data indicate that the sediments in the strand plain are holocene sands on the top, sands and clays under it and tertiary sediments at the bottom. The beach dune sediment yield themselves to a four fold grouping. In all the boreholes the stratigraphic columns the Vaikom beds, Quilon beds, Warkalli beds and the top layers of holocene sands are seen. The Vaikom beds probably represent a fluviatile facies which formed along the slopes and depressions probably as alluvial fans or channel fill deposits. The overlying Quilon sediments are unequivocally of marine origin; resulting from the invasion of the area by the sea. However it seems that the sea has withdrawn or the shoreline migrated westward making room for the deposition of Warkalli beds. The phase might probably have been synchronous to the Late Miocene regression, during which sea-level fluctuated rapidly, dropping down to a maximum of 65 fathoms and reaching somewhere near its present level. This might have happened 25,000 to 30,000 years before present. During the holocene, there might have been a period of rapid transgression, followed by a period of slow transgression and then a period of relative stability. The gradual evolution of the coastal plain may be attributed to the above phases in combination to the abundant supply of sediments brought down by the numerous streams. The configuration of the coastline had been continuously varying and is facing a period of erosional transgression at present. The length of the present coast line of Kerala is 560 km. and is almost straight for over a great part of its length from Calicut to Quilon. In other parts however, indentations and protuberances are not uncommon.

Physical Aspects: The physical aspects of the Kerala region is clearly illustrated in the description of the physiography of the erstwhile Travancore State by Lieut. Conner in his report on the survey made at the beginning of the nineteenth century. It is worthwhile to quote it in view of the large scale alterations brought in by human inheritance to the natural landscape of the State. Conner's report runs as follows:— The face of the country presents considerable diversity, although its general character, except the southern parts, is extremely abrupt and mountainous. The coast, for a short distance a long the borders of the lake* is generally flat; retreating from it, the surface immediately becomes unequal, roughening into slopes which

* Lake refers to the chain of back waters.

gradually combine and swell into the mountainous amphitheatre that bounds it on the east, where it falls precipitately, but terminates less abruptly on the south. The collected villages waving plains, palmyra topes and extensive cultivation of Nanchanad resemble in every particular the neighbouring province of Tinnelvelly, except that in no measure partakes of its comparative arid sterility. Approaching northward this fertile plain is succeeded by the woody and rugged surface of the genuine 'Malayalam'. some few champaign tracts enclosed within this ocean of forest relieve the uniformity of the sylvan scene. The extent lining the coast for its whole length presents a fertility so near the sea that it imparts a peculiar character to the landscape. This rich and variegated tract is flanked by a mountainous barrier and is finally contrasted with the sombre magnificence and desolate solitude of those wilds of which the elephant seems the natural master; and though the landscape may be too much made up of this wild scenery, it boasts of many striking localities and peculiar beauties, if not the sublime, at least romantic and picturesque kinds. The eye is arrested by the wild, rocky, precipitous acclivities and fantastic forms assumed by the mountains in the more southern parts; but proceeding north the bold and elevated contour of the alpine tract is less sharply defined; a few rugged cliffs and spiry points or conical summits alone breaking through the sameness of its rounded and sombre outline. This apennine dissolves into clustering hills and romantic inequalities at whose feet wind innumerable valleys presenting (particularly in the middle parts) the most delightful landscapes whose natural beauties are embellished and diversified by the prospect of churches and pagodas. Indeed, the endless succession of houses and gardens scattered in picturesque order over the face of the country gives it entirely a different appearance from the other coast, the nudity of whose plains is unfavourably contrasted with the robe of florid and exuberant vegetation that for a great part of the year clothes 'Malayalam'. The areca and coconut everywhere fringe those picturesque and sequestered glens, which gradually expand into the extensive plantations and cultivated lands that skirt the sea and lake. This space is enlivened and fertilized by innumerable rivers and pastoral streams whose borders are

* The Sn up of the regions S of Parassala, presently in Tamilnadu.
* Refers to the land of 'Malayalam'.

crowned with groves and cultivation that, everywhere, following their winding course, present a unique, interesting and charming scenery infinitely more diversified than most other parts of the peninsula and one that would indicate abundance. This is especially the case in Kuttanad, the watery flatness of this fertile fen is relieved by the gardens and habitations so thickly strewn over its surface which exhibits a network of rivers meandering through the verdure they create.

It has also been remarked that "it will be difficult to name another land which, within so narrow limits, combines so many, so varied and much precious natural blessings". Although Conner's description was on the physical aspects of Southern Kerala, it is binding upon the general attributes of physiography of other parts of Kerala as well. However, it may be mentioned that large scale deforestation, extensive transference of natural wood lands into monocultural gardens and intensive reclamation of marshes and margins of kayals have affected the land systems significantly and have also resulted in the scrapping of natural vegetation, particularly in the last two scores of years.

Mountains and Peaks. The mountains forming the Western Ghats range from 915 to 1525 metres above sea-level on the Coorg and Wynad slope with one or two peaks rising over 1825 m. and upto nearly 2430 m. But on the Nilgiri-Kundalface the average height springs upto over 1825 m. It falls again to about 1225 m. and lower on the Southern slopes of Nilgiris and again rises to a high altitude in the Vadamala, fringing the northern edge of the Palghat gap. On the south edge of the gap the Tenmala, outliers of the lofty Anamala mountains commence with an elevation of 1225 to 1525 m. above mean sea level. Dwarfed into insignificance, compared with the Ghat mountains in the background, there also occur, dotted about on the plain country, several hills of considerable elevation.

Among the peaks rising abruptly from the Wynad plateau at an average elevation of 915 m. the most noteworthy are the Banasura mala (1912 m.) and the Brahmagiri peak (1608 m.) The Banasuramala derives its name from the allusion that the fort of the mythological character Banasura was situated at its

summit. Brahmagiri is believed to be the abode of Lord Brahma. Eight kilometres to the north of Manantoddy is a lofty ridge branching off from the Ghats and six kilometers to its north is the Brahmagiri peak. This ridge forms the limit common to Coorg and Wynad and between these two ridges lies the valley of Tirunelli. The Peria Ghat is an important pass into the Wynad plateau and the main road passes from it through Manantoddy to Mysore. The smuggler's pass from Dindigal to Manattana is a minor one. From Morampara hill at the head of the Peria Ghat one can have a panoramic view of the lowland upto the coast. At the foot of the Ghat which are here at 1,225 to 1,525 m. are the Kannoth and Kottiyoor reserve forests. Kanakamala a lofty spar of the Ghats projects into the plains within 16 kilometres of Tellicherry. The isolated ridge in Tellicherry taluk, the Puralimala has played a notable part in the historic Pazhassi struggle. The Veidalmala (1371.6 m.), a long, level, grassy mountain ranging transverse to the Ghats in Taliparamba taluk ends precipitously on its western face. The Ezhimala on the coast, which is only 260 m. in height, had been a land mark from historic times.

The highest mountain in the Ghat section within the district of Kozhikode is the Vaval mala (2339 m.) in Ernad taluk. The mountains in Palghat section range in height from 915 to 2133 metres and are spread over all the taluks in the district. The most important among these are the Ananginada(2386 m.). Karimala (1998 m.) and the Padagiri (1585 m.) The ranges that form the portion of the Western Ghat in Trichur district range in height from 330 m. to 1440 m. above mean sea level. Among the labyrinth of these ranges, some rough elevated table-lands are to be found. The hills in Ernakulam district are mostly under 915 m. in elevation. The most noteworthy among these are the Kudayathur Vindyans a group of hills ranging in altitude around 915 m.

The Ghat section in Idukki district constitute numerous mountains of great height and varied configuration and the associated uplands. The mountains in this section rise to elevation of more than 2,000 metres with high plateaus in between and some of the loftier ones are entirely detached from

the surrounding lands. The Western Ghats in this district reaches the highest elevation in the Anamudi (2817.06 m.) which is the highest peak in Kerala and the highest in India next to those of the Himalayas. There are several other peaks more or less near the Anamudi, varying in elevation from 1981.31 m. to 2698.68 m. These mountains together with the summit plain from which they rise from the *High Ranges.* Though often termed as a plateau, the High Ranges is really a succession of high hills with deep valleys between them, comprising also of several small plateaus like Gudarmala, Devikulam, Anaycoodu, Eravimala, Perumalmala, Anchanad and Vattavada. These plateaus are at heights ranging from 935 m. to 2,225 m. Even the valleys in High Ranges are above 935 m. in elevation.

The height of the Western Ghats decreases toward south. In the Pathanamthitta and Quilon districts the average elevation is 1220 m. The highest peaks in Pathanamthitta section are the Sivagiri mala (1744 M.) and the Meen Mala (1734 m.) The maximum height attained in the Pathanapuram section (Quilon district) is at Muthira mala (1041.5 m.). Further south in Trivandrum district the average height falls to about 300 m. However the peak Agasthyamudi near the boundary of Nedumangad with Neyyattinkara taluk, rises to a lofty height (1869 m.). Another important hill is the Mukkunni malai (1074 m.) in Neyyattinkara taluk. From the mountains in the east, the land slopes to the west in a series of hills and valleys traversed by several rivulets.

The noteworthy peaks of the Western Ghat region are listed in Table 1.

Drainage : The drainage pattern of the region is in conformity with the physiographic divisions, with the summit of the Western Ghats forming the watershed between the drainage system of Kerala and that of the Eastern plains. There are 41 west flowing rivers in the Kerala region, the majority of which drain themselves into the kayals. (see Table 2.). The highland region of the Western Ghats comprises the sediment sources zone, while the midland and parts of lowland areas are the transfer zone for most of the drainage basins.

Analysts have pointed out that there are two knick points for the rivers at 500—800 and 90—150 metre elevations, which correspond to two prominent breaks in slope and mark the boundary between the Midlands and the Low lands respectively. One of the characteristic features of the rivers in the Kerala region is their having almost straight course. This, coupled with the nature of the river profiles suggest that the drainage pattern is controlled to a great extent by tectonic features. Diversity of drainage patterns and stream directions is observed in the hilly regions. These must have been the remnants of earlier drainage, constantly captured and eliminated by the headward erosion of the present westerly drainage. The majority of the rivers in Kerala flow in a general westerly direction. Most of the rivers follows the structural trend of rocks. In the coastal plains, which are covered by a thick mantle of alluvium and laterite, the streams flow with a low gradient towards the sea.

The rivers have incised drainage pattern controlled by structural features—faults, shear zones and joints. The knick points cited above as observed by researchers may indicate neotectonic isostatis movements, the details of which are yet to be brought out through Geophysical observations.

Although dimensionally small in comparison to rivers in other parts of India, the rivers in Kerala gain prominence on account of the heavy load of water and sediment drained annually, contributed by the copious rainfall and the rapidly falling terrain. The forty one west-flowing rivers mostly have their source in the Western-Ghats and drain into the Laksha dweep sea either directly or through the Kayals. Ten of these rivers have a portion of their catchment areas in the neighbouring States: either in Karnataka or in Tamilnadu. Apart from the forty one rivers listed in table 2; there are a few more streams such as the Kumbla, the Kalnad, the Bekal, the Pooraparamba etc. which have separate watersheds and exit directly or through the backwaters into the Lakshadweep sea. However these rivers are very small, having lengths less than 15 km. Although they have not been discussed separately, their catchments and

water resources have been considered along with those of the large basins adjacent to them. Brief accounts of the important rivers is given below:—

WEST FLOWING RIVERS

1. **Manjeswar River** : Originating from Balepuni hills on the border between Kerala and Karnataka at 60 m. above mean sea level, the river Manjeswar flows through the villages Vorkadi, Pavuru and Badaje and then enters Manjeswar town. After a 16 km. course, this river falls into the Uppala kayal. The extent of the basin is 90 sq. km.

2. **Uppala River** : Uppala river rises at about 150 m. above Mean sea level from the Virakamba Hills in Karnataka and enters Kerala after a southward course of 7 km. and runs through the state boundary for about 6 km. In Kerala it flows Westward through the villages Minja, Kuluru, Bekuru and Kodibail all in the Kasaragod taluk. The estuary of this 50 km. long river has widened itself into a small lake, through which the Manjeswar river finds its exit. Out of the total catchment area of 250 sq. km. of this river, 174 sq. km. lie within the state of Karnataka.

3. **Shiriya River** : Originating from Anekundi Reserve forest in Karnataka, at an elevation of about 230 m. above Mean sea level. Shiriya flows 11 km. towards west and then turns north and flows in that direction for 6 km. through Karnataka. Then it follows a westerly course for 30 km., changes its direction and flows in a South-westerly direction for 8 km., through the villages Puttige, Mugu, Angadimogaru, Badoor, Maire, Kundlamerkala, Arikadi, Ujar, Ulvar and Bombrana. The river then flows a westerly direction for 10 km. and then in a south-westerly direction for 3 km. through the villages Kayyar, Ichlangod, Shiriyaand Bombrana before joining the sea through the Kumbla backwaters. The Kumbla a small originating in Edanad also empties into the same backwaters. The Pallaradka hole, one of the tributaries to Shiriya, also originates in Karnataka and joins the main river from the left in Angadi mogaru. The other important tributaries are the Kallajethodu, the Kanyana

thodu and the Eramatti Hole. The upper reaches of the main river are variously known at different reaches. The length of Shiriya is 67 km. and the total drainage area 587 sq. km. out of this, 297 sq. km. lie within Karnataka.

4. **Mogral River** : The 34 km. long Mogral river has its entire course within Kerala. Rising from Kanathur in Karadka R. F. it flows through Bettipadi, Muliyar and Yedhir. From Yedhir, the river meanders through fairly flat regions in the villages Madhur and Patla and empties into the sea after forming a stretch of backwaters. 5 km. long. A distance of 20 km. of the course from the mouth is tidal. The area of the basin is 132sqkm.

5. **Chandragiri River** : One of the major rivers in the state, the Chandragiri river originates at 1,220 m. above Mean sea level from PattiGhat R. F. in Karnataka. Its main tributary Payaswani also rises from PattiGhatat 1350 m. above Mean sea level. These two tributaries combine to form the main river at about 15 km. upstream of its mouth. The river has a total length of 105 km. and drains an area of 1,406 sq. km. of which 836 sq. km. lie within Karnataka. After the confluence with Payaswani, the waters of Chandragiri become tidal. The river flows to north and then south widening itself and forming small braids (thuruths) which hardly stand above water during floods. The river winds round the Kasargod town in U-shape, before its entrance to sea. The left arm expands into a long stretch of backwaters. The minor port of Kasaragod is located here. There is very evidence for this river having shifted its course at the mouth.

6. **Chittari River** : The Chittari basin includes the watersheds of the rivers Kalnad, Bekal and Chittari. The small stream Kalnad rises from Chettianchal hillocks at an elevation of 91 m. Kalnad stream is 8 km. long and joins Kalnad backwaters at 2 km. upstream of its outlet to sea. The extent of the basin is 16 sq. km. The Bekal river is formed by the joining together of two small streams originating from Kaniyadka and Maladka respectively. Though the river rises at an elevation of 75 m., it abruptly drops to 15 m. in the course of about 3 km. The

length of Bekal river is 10 km. The area of its catchment area is 32 sq. km. The tidal reach is upto 3 km. from the mouth. The Chittari is formed by a number of rivulets—originating from Cherambe, Tayakulam and Pullur which flow down to form a backwater before emptying into the Lakshadweep sea. 25 km. long, the Chittari drains an area of 97 sq. km. The river is tidal for about 6 km. from the mouth.

7. **Nileswar River** : Rising from Kinanur in Hosdurg taluk, the Nileswar river is known as Pallichal thodu in its initial reaches. Its main tributaries Aryangal thodu and the Baigote Hole join the main river 8 km. downstream of its origin. Though the source of the river is at about 140 m. above Mean sea level the bed falls to 15 m. elevation within a course of 8 km. It joins the Karingote river towards its mouth at Kottappuram to the South-West of Nileswaram town. The length of the river is 46 km; the last 10 to 11 km. reach being tidal. It has a drainage area of 190 sq. km.

8. **Karingote River** : Originating at an elevation of 1520 m. in Coorg district, Karnataka, the Karingote, one of the major rivers in Kerala, flows down the steep of the Western Ghats in the initial reaches until the bedlevel falls to 460 m. within a distance of 8 km. Its two main tributaries, the Mundore and the Padianmala Hole join at a level of 250 m. Another tributary, the Mundroth Hole joins the main river at Pulingom at a bed—level elevation of 36 m. Almost all the main streams in Karingote system flow in a South- Westerly direction. After the confluence with the Nileswaram river, the channel gets split into several distributaries before falling into the sea near Thuruthi. The common estuary of the Karingote and Nileswar rivers extended southwards parallel to the coast forming the long stretch of Kavvai kayal. The Karingote river has a length of 64 km. with a catchment area of 561 sq. km. About 132 sq. km. of its catchment lie within Karnataka.

9. **Kavvayi River** : This is a small river which originates in Cheemeni village at 385 m. above Mean sea level and flows past Alpadampa and Vadasseri before emptying into the Kavvai kayal at Udamanthai. It has a length of 31 km. and a catchment area of 143 sq. km.

10. **Peruvamba River** : Rising from Pekkunnu in the slopes of Western Ghats at 325 m. above Mean sea level, the 51 km. long Peruvamba river flow through the villages Peringoni, Kuttur, Mathamangalam and Kunhimangalam. To the east of Ezhimala, the river bifurcates: one branch falls into the Kavvayi kayal and the other empties directly into the sea. The Macharuthodu, the main tributary of this river also originates from Pekkunnu and joins the river at Mathamangalam. Peruvamba has a drainage area of 300 sq. km.

11. **Ramapuram River** : This is a small river 19 km. long, which joins the southward branch of Peruvamba river and empties into the sea to the south of Ezhimala. It has its origin at 57 m. above mean sea level in the Iringal hills, flows through the villages of Pariyaram, Kolapratvayal, Cheruthazham and Madai and has a total basin area of 52 sq. km.

12. **Kuppam (Payangadi)River** : The kuppam river otherwise known as Payangadi river flows through the Taliparamba and Cannanore taluks. It originates from the Padinalkad Ghat reserve forest in Coorg district, Karnataka at an elevation of 1630 m. The length of the river is 82 km. The Kuppam system drains a total area of 539 sq. km. of which an area of 70 sq. km. is in Karnataka. Its main tributaries are the Pakkattupuzha, Alakutta thodu, Kuttilole puzha, Mukkutta thodu and the Chiriya thodu. The river has a steep course in its initial reaches but on entering Kerala State after a run of 12 km, the bed-level falls to 115 m. It follows a course almost parallel to that of Valapattanam river but at Payangadi takes a sudden twist to the south and flows parallel to the coast. It therefore joins the Valapattanam estuary before its exit into the sea. The combined mouth of these rivers have now been transferred into the minor fishing port, Azhikkal.

13. **Valapattanam River** : Valapattanam river originates from the Brahmagiri Ghat Reserve forest within Karnataka at an altitude 900—1350 m. above Mean sea level and drains into the sea at Azhikkal after combining with Koppam river. About 19 km. of its upper reach is within the boundaries of Karnataka. Entering Kerala, it flows through the villages Iritty, Perunana,

Irikkur, Kallisseri and Valapatanam. The major tributaries of this river are the Sreekantapuram river, Valiapuzha, Venipuzha and the Aralam Puzha. The basin is very undulating, the cultivable land lying mostly in the valleys. The total drainage area of this river basin is 1,867 sq. km. of which 546 sq. km. is outside the State. The length of the river is 110 km. of all the rivers in the Malabar region, maximum volume of water is drained by the Valapattanam system.

14. **Anjarakandy River :** Having its origin in the Kannoth reserve forest at an altitude of 600 m. above M. S. L., the Anjarakandy river traverses through dense forest and hilly terrain in the upper reaches for a distance of 16 km. The river falls rapidly and at Kannavam, the bed-level is at 90 m. above M. S. L. Two small tributaries the Kappu thodu and the Idumba thodu join the main river near Kunderipoyil. Thereafter the river takes a winding course till Orikkara where it bifurcates, one branch heading south towards the sea to empty itself at 3 km. north of Tellicherry town. This branch of the river which winds around the Dharmadom island is locally known as Dharmadam puzha. The other branch falls into the sea 5 km. north of Tellicherry. The basin has an area of 412 sq. km., entirely within Kerala. The length of the river is 48 km. The valley of Anjarakandy is especially suited for the cultivation of exotics.

15. **Tellicherry River:** This river also known as Ponnayam river, has its source in the Kannoth R.F. at an elevation of 550m. above Mean sea level. Its only right bank tributary joins the main river about 14 km. above its mouth. The Tellicherry river, having a length of 28 km. and a drainage area of 132 sq. km. flows through the villages Cheruvancheri, Mudiyanga, Pattayam, Mokeri and Pandakkal. At Pandakkal, it still forms the boundary of the Mahe enclave. This river used to be known as Koodali river, on account of the location of the ancient fort of that name at its mouth.

16. **Mahe River:** The Mahe river, also called Mayyazhi puzha has its source at 910 m. above Mean sea level on the Western slopes of the Wynad Hills. The river has no major tributaries,

but is fed by a number of rivulets from either side. This 54 km. long river passes through many agricultural villages of moderate settlement before falling into the sea at Mahe about 6 km. south of Tellicherry. The last reaches of this river serves as the boundary line between Mahe and Kerala region. The area of Mahe basin is 394 sq. km.

17. Kuttiyadi River: Rising from the Narikota ranges on the western slopes of the Wynad Hills, at an elevation of 1220 m. above Mean sea level, the Kuttiyadi river flows through Badagara, Quilandy and Kozhikode taluks. The river is also known as Murat river. It falls into the sea at Kottakkal 7 km. south of Badagara. The Kuttiyadi river has a length of 74 km. and along with its tributaries drains an area of 583 sq. km. The major tributaries of this river are the Onipuzha, the Vannathipuzha, and the Madappallipuzha. The historical Kottakkal fort is situated at the mouth of this river. Hence this river has derived the name Kottapuzha.

18. Korapuzha: This river is formed by the confluence of the Agalapuzha outlet with the Pannur puzha. While Agalapuzha is more or less a backwater, the Pannurpuzha originates from Arikkankunnu at about 610 m. above M.S.L. The Korapuzha falls into the sea at Elathoor. The total length of Korapuzha is 40 km. and the area of its basin is 624 sq. km.

19. Kallai River: The Kallai river has its origin in Cherikkulathur, at an elevation of 45 m. Winding through many villages of thick settlement, the river empties into the sea near Kallai, the famed timber-trading centre. The stream which forces its way to the sea only during monsoon period is an insignificant one and attains a length of 22 km. only. Connected with it is an extensive backwater which is looped on to the Beypore river by a narrow creek.

20. Beypore River (Chaliyar): This is one of the major rivers of Kerala. It orginates from the Ilambaleri hills in Tamilnadu, at an elevation of 2066 m. above M.S.L. The important tributaries of this river are the Chalipuzha, Punnapuzha, Pandiyar, Karimpuzha, Cherupuzha, Kanhirapuzha, Karumbanpuzha, Vadapurampuzha, Irinjipuzha and Iruthilly puzha. This inter-

state river commands a drainage area of 2,923 sq. km. of which 388 km. empties into the sea to the west of Feroke town. The mouth of this river has been coverted into a minor fishing port.

Beypore river draws a great part of its waters from above the crest of the Ghat ranges, and in this aspect stands unique among the rivers of the Malabar region. It is famed of old, for its auriferous sands. The three main tributaries of this river unite a few kilometres above Nilambur. The eastern tributary, the Karimpuzha rises below Mukurti peak and drains the densely wooded valley between Gulikal hill and the Nilgiri and Makurti peaks. The middle one, the Ponpuzha (Gold river) drains the Ochterlong valley and the south-east of the Marappanmadi of the Nilgiri—Wynad area and passes over the ridge of the Ghats in a succession of rocky cataracts a few kilometres south of the Karkkur pass. The Western most tributary the Chaliyar leaps down from the crest of the Wynad hills in a magnificent waterfall near the Chalad pass and drains the valley east of the Vavumala. The three steams reinforced by many large feeders unite in the heart of the famous teak plantations in the middle of the Nilambur Valley. The area around this confluence have been yielding minor quantities of gold collected from placer deposits.

21. **Kadalundi River:** The Kadalundi river known also by the names Karimpuzha and Oravanpurampuzha is formed by the confluence of its two main tributaries, the Olipuzha and the Veliyar. The Olipuzha takes its origin from the Cherakkomban mala at an elevation of 1,160 m. above M.S.L. The Veliyar rises from the forests of the Erattakkomban mala at an elevation of 1,190 m. above M.S.L From the wilds of the Silent Valley, the river flows down through Eranad and Valluvanad taluks and empties itself into the sea at about 5 km. south of Beypore, after a circuitous course of 130 km. Close observations in the basin has revealed shifts in the course of Kadalundi. The drainage area is 1,099 sq.km. Based on a project, proposed as early as 1857 to complete an uninterrupted system of water communication from Badagara to Trivandrum, several attempts were made to construct a navigable canal from Kadalundi to Bharathapuzha. The creek so made is still existent but is

impassable except for small country boats; that too at the peak of the monsoon. The oily mud which oozes up from below into the water of the canal causes great obstruction to navigation.

The Pooraparamba, a small river 8 km. long is also to be included in the Kadalundi system. Including its drainage area of 23 sq.km. the total area of the Kadalundi basin may be conceived as 1,122 sq.km.

22.Tirur River: This is a small river, 48 km. long draining an area of 117 sq. km. Rising at an elevation of 86 m. in Atavanad in Tirur taluk, it traces a S. Westerly course in its initial reaches upto Tirunavaya, wherefrom it changes to a N. Westerly course. After some distance it resumes its original direction till its confluence with Bharathapuzha to the North of Ponnani town. In its upper reaches, the Tirur river is known as Vallilapuzha. Tirur town is located within this basin.

23. Bharathapuzha: This is the second-longest river in Kerala. The Bharathapuzha has its origin from the Anamalai Hills at an elevation of 1,964 m. above M.S.L. and flows thrugh the district of Coimbatore in Tamilnadu into Kerala and then through Palghat, Malappuram and Trichur districts, to join the sea finally near Ponnani town. Bharathapuzha has four important tributaries viz. (i Gayatri puzha, (ii) Kannadi puzha (Chittur puzha), (iii) Kalpathipuzha and (iv) Thuthapuzha,.

Among these major tributaries, Gayatripuzha originates from Anamalai Hills. In the downward course it touches Kollengode, Nemmara, Alathur, Wadakkancheri, Koniazhi and Pazhayannur and joins the main river at Mayannur. Gayatri puzha has five subtributaries viz., (i) the Mangalam river in which the Mangalam dam is located, (ii) the Ayalurpuzha in which the Pothundy dam is located; (iii) the Vandazi puzha; (iv) the Meenkara river in which the Meenkara dam is located; and Chulliar in which the Chulliar dam is located. The Cherrakuzhi weir is located across the Gayatri river near Pazhayannur.

The Kannadi river also rises from the Anamalai Hills, flows through Thathamangalam and Chittur and joins the main river

near Parali. Three sub-streams combine to form this river: they are (i) the Palar. (ii) the Aliyar and (iii) the Uppar. The Chitturpuzha project is located on this tributary. In the upper reaches of Aliyar, the Tamilnadu Government has constructed two reservoirs.

The Kalpathipuzha is formed by four streams; the Koraiyar, the Varattar, the Walayar and the Malampuzha. Koraiyar and Varattar originate from the Anamalai Hills and after their confluence, flow towards west to join with Walayar near Tampalam. The river is thereafter called Koraiyar. The Malampuzha river jons the Koraiyar about 10 km. downstream. A major irrigation reservoir of Kerala, the Malampuzha is located on this stream. The Walayar reservoir is the second irrigation project in this part

The Thuthapuzha starts from the Silent Valley hills and after a circuitous course, joins the main river about 2 km. from Pallipuram railway station. The important streams which feed Thuthapuzha are the Kunthipuzha, Kanjirapuzha, Ambankadavu and Thuppanad puzha The Kanjiramukku thodu is also included in this basin.

The 209 km. long Bharathapuzha has an extensive basin of 6, 186 sq.km. This basin is spread over 11 taluks from Western Ghats to the Sea. About two thirds of the drainage basin is 4,400 sq. km. lie in Kerala State while the rest of the area is in Tamilnadu. However the area among the mountains exposed to the full force of the S.W.T monsoon is comparatively small. In hot weather, the wide sandy bed of the river is almost dry except for a few miles from its mouth; but in the monsoon, laden boats ascent from the mouth region to considerable distances. The estuary at Ponnani is perennially open to sea. Northward from the estuary, a wide reach of backwater stretches away upto Tirur and to the south the river is linked by a canal with the Velliankod and Chettuvai backwaters and ultimately with the long line of inland water way that ends only by Trivandrum.

24. Keecheri River: Also known as Wadakkancherry river or Alur puzha; this small river originates from Machad mala at

abut 365 m. height. In the upper reaches, it flows in a N.W. direction upto Nellai and then traverses westward upto Choondal. Having met with its only tributary the Choondal thodu; the river turns s. westward to join the Kolè Canals—the drainage outlets from Enamackal lake, the Mathukkara. The combined channel then moves down to the sea through Chettuvai estuary. The total length of Keecheri river is 51 km. It has a total drainage area of 401 sq. km.

25. **Puzhakkal River:** The streams Parathode and Poomala thodu originating from the hills of Killanoor Village combines with the Naduthode flowing down from Manalithara hills to form a small river. This is further joined by the Kattachirathodu originating from Mudikotty. The Puzhakkal river thus formed covers a channel of 29 km. and flows past the northern outskirts of Trichur town before draining itself into the Kole lands. The area drained by Puzhakkal is estimated to be 234 sq. km.

26. **Karuvannur River:** This river originates from the Western Ghats and is fed by its two main tributaries viz., the Manali and the Karumali. The Manali originates from Vaniampara hills at an elevation of 365 m. The Chimony and Muply, the two sub-tributaries of the Karumali, originate from Pumalai at 1,100 metre height. The Pillathodu joins the Karumali just downstream of the confluence of Chimony with Muply. Manali and Karumali join together at Palakkadavu near Arattupuzha. The Karuvannur river then takes a s. westerly direction upto Panamkulam and then a westerly course. Just before it joins the backwaters, it bifurcates. One of these branches flows northward and enters the sea at Chettuvai. While the other traces a southward course to join the Periyar at Kodungallur. The length of Karuvannur river is 48 km; the area of the basin is 1054 sq. km.

27. **Chalakudy River:** The Chalakudi river is formed by the confluence of five streams, originating from Anamalai Hills viz., Parambikkulam, Kuriakutty, Sholayar, Karappara and Anakkayam. All these rivers rise at elevations above 470 m. Of these Parambikkulam river and Sholayar have their origin and initial reaches within Tamilnadu, thus rendering the Chalakudi an interstate river. In the initial course, this river passes through thick

forests and the channel contains many water falls until it reaches the plains at Kanjirappally. Chalakudi river empties into the right arm of Periyar at Puthenvelikkara. The river derives its name from the Chalakudi town located within its basin. The length of this river is 130 km. Out of the total drainage area of 1,404 sq. km., about 300 sq. km. is in Tamilnadu.

28. Periyar: This is the longest river in Kerala and also is the largest in potential. The Periyar river is formed by the confluence of a number of rivulets originating from the Sivagiri Hills at elevations above 1,830 m. From its origin, the river traces a rocky northward path, receiving several streamlets on way. About 48 km. downstream, the Mullayar joins the main river at a bed-level elevation of 854 m. In the course of the next sixteen kilometres the river is again met by several streams and about 11 km. down stream it passes through a narrow gauge. Thereafter the Periyar changes its course and flows in a north-westerly direction and winds through till it reaches Vandiperiyar. The river then passes through another gorge below which it is joined by the tributary Perumthurai Aar. Periyar continues in a northerly direction for about 18 km. till the confluence of Kattappana Aar at an elevation of 640 m. The direction of course changes to north-west thereafter. The path of the river continues through the Idukki gorge between the hills Kuravan mala and Kurathi mala. Below the Idukki gorge it is joined by the Cheruthoni Aar at 540 m. height. After this the river turns north, till the confluence of the Perinjankutty Aar at an elevation of 305m., and continues in the same direction till the joining point of its major tributary, the Muthirapuzha which come from the opposite direction. After this confluence, the Periyar takes a west-north-westerly direction and descends by about 244 m. within a distance of 15 km. At Kokkaranipara, the river spills over a cliff, about 30 m. in height. The course below this is beneath an overhanging rock and in summer days, the river seemingly disappears for some distance. From Karimala, 16 km. downstream of its confluence with the Muthirapuzha, the Periyar is navigable for country boats. The Thotti Aar joins the main river from right. Further down, the river is joined by the Idamala Aar. The river falls very gently upto Kayattuvakayam and then takes a rapid succession upto

Malayattur. In this reach it receives a few more streams. After Malayattur the river winds its way for a distance of 23 km. through Kalady and Chowara and reaches Alwaye, where it gets bifurcated into the Mangalapuzha branch and the Marthanda Varma branch. Upstream of this break, a small distributary loops off at Kaladi which rejoins the Mangalathupuzha at Chengamanad. The Mangalathupuzha flows north west and receives the Chalakudi river at Puthenvelikkara and then broadens itself into a backwater at Munambam. At this point, the bed-level reaches below Mean sea level and the river course is tidal. The river finally empties into the sea. The other distributary (Marthanda Varma branch) flows in a southerly direction, initially splits up into two dissecting the industrial regions here and before emptying into the Varapuzha kayal splits further into several branches.

The length of Periyar from its origin to its confluence with the sea is 244 km. The river has a drainage area of 5,398 sq. km. out of which 115 sq. km. is in Tamilnadu.

29. Muvattupuzha River: The Muvattupuzha river is formed by the confluence of three rivers, the Thodupuzha Aar, Kaliyar and Kothamangalam river. The main tributary the Thodupuzha Aar, rising from the Tharagamkanam hills at 1,094 m. above Mean sea level is joined by several rivulets from either side along its 38 km. course and it joins the other two main tributaries near Muvattupuzha. The tail waters from Moolamattam pumphouse connected to Idukki project are being drained into Thodupuzha and this significantly increase the capacity of this river. The Kaliyar 44 km. in length is joined by Kothamangalam river, 2 km. upstream of its confluence with Thodupuzha Aar. The Muvattupuzha river after covering a course of 15 km. mostly through low lands, bifurcates at Vettikkattumukku into the Murinjapuzha and the Ithipuzha which further split into several channels before finally emptying themselves into the Vembanad Kayal. The length of Muvattupuzha river is 121 km. The total drainage area of 1,554 sq. km. is spread over 45 villages of dense settlement.

30. Meenachil River: The initial reach of the Meenachil river is the Kadapuzha flowing down from Western Ghats as a combination of several streams. It is joined by Konipad thodu to form the Kalathukadavu Aar. The Trikkovil Aar joins it at Cheripad. The Poonjar river combines with the main river at Erattupettah. At this point the river takes a sharp turn from a southerly direction to a westward course until the confluence with Chittar at Kondur. Another tributary, Payyappara thodu joins it at Lalam. A few miles upstream of Kottayam, the river bifurcates and the first branch flows northward to join the Vembanad kayal through a criss-cross distributary system. The other branch initially flowing westward takes a sudden turn to the south, skirting the Kottayam town and finally ends in Vembanad kayal through split channels. The Meenachil river is 78 km. long and has a drainage area of 1,272 sq. km.

31. Manimala River: Rising at an altitude of 1156 m. above M.S.L. in Tatamala, the river flows through estate lands, fed by several rivulets enroute. From Manimala it continues in a winding course and finally joins the Pamba river at Neerettupuram. The river passes through many places of importance and drains an area of 847 sq. km. The length of the river is 90 km.

32. Pamba River: The Pamba river, the third longest among rivers in Kerala, is formed by the confluence of Pamba Aar, Kakki Aar, Arudai Aar, Kakkad Aar and Kall Aar. The Pamba Aar in turn is formed by several streams having their origin from Peermade plateau at altitudes above 1650 m. The Pamba after receiving the Kakki Aar flows in westerly direction till the Arudai Aar joins it near Udumpara malai. The river then turns, south-westward till Perunthenaruvi. At Narayanamuzhi it turns and follows a south-easterly course until the Kakkad Aar joins it at Perunad. Then it takes a south-ward course upto Vadasserikkara where it is joined by Kallar. From this point the river flows north-west till Ranni. Thereafter it traces a westerly course upto Kuriannur, turns south towards Kozhencherry and again flows west upto Pandanad. Here the river bifurcates; one branch flowing in a south westerly direction to Neerettupuram, where it is joined by Manimala river. The other branch continues

westward, receives Achencoil river at Veeyapuram, splits and flows around Parumala and finally rejoin Pamba. After the confluence with Manimala river, the Pamba river branches off into several channels such as Nedumudi Aar and Palluruthy Aar and finally empty into the Vembanad lake.

The Pamba river has a course of 176 kms. and a basin of 2,235 sq.km. in extent. The distributary system in its lower reaches along with the low lands bordering the Vembanad lake from the Kuttanad.

33. Achencoil River: Several small streams orginating at altitudes above 700 m. join together to form the Achenkoil river. At Tharamukku, a canal branches off from this river, known as Kuttemperoor canal, which joins Pamba river. Achencoil river then continues westward and again splits into various channels. The main branch flowing in a North-westerly direction joins the Pamba at Veeyapuram. The other branches drain directly into the kayal. 128 km. long, the Achencoil river drains an area of 1,484 sq.km. The basin contains many important centres and towns.

34. Pallickal River: This river rises from the southern slopes of Kalaritarakkunnu at an elevation of 60 m. above Mean sea level. After a winding course of 42 km., it empties into the Kozhikkottu kayal near Karunagapally. The Pallickal basin is 220 sq. km. in area.

35. Kallada River: This river is formed by three rivers, the Kulathupuzha, Chendurni and Kalthuruthy which join together near Parappar. From Parappar, the river flows north-west under the name Punalur Aar upto Urukunnu and then westward upto Mukkadavu where it is joined by a small tributary. Taking a North-westerly direction upto Pathanapuram, it again flows west upto Enath. Thereafter it traces a south-westerly course till its fall into the Ashtamudi kayal. The length of this river is 121 km. and the area of the basin is 1,699 sq.km.

36. Ithikkara River: Originating from Madathara at a height of 240 m. above Mean sea level, the 56 km. long Ithikkara river drains an area of 642 sq. km., before emptying into the Paravur kayal.

37. Ayroor River: Another small river, 17 km. long which rises at Navaikulam, flows west and empties into Nadayara kayal. The area of its basin is 66 sq. km.

38. Vamanapuram River: The Vamanapuram river originates from the Chemmunji Mottai, at about 1,860 m. above Mean sea level. Its main tributaries are the Kalaipara Aar, Pannivadi Aar, Ponmudi Aar, Chittar and Manjappara Aar. After the confluence with upper Chittar it flows westward, receives Manjappara Aar and continues its western course. About 3 km. downstream from Palode, there is a 13 m. fall known as Meenmutti. About 3 km. downstream from Vamanapuram the Kilimanoor Aar joins it. The river falls into the Anjuthengu kayal after covering a course of 88 km. The drainage area in 687 sq. km.

39. Mamom River: This is another small river emptying into the Anjuthengu kayal near Chirayankil. During its course a channel branches off from the main river at Koonthallur to join the Vamanapuram river. Having its origin at Panthalakkottu Hills, it traces a course of 27 km. and drains 114 sq. km.

40. Karamana River: The Karamana river has its origin from Chemmunji Mottai at an elevation of 1,605 m. above Mean sea level. The river is formed by the confluence of several streams such as Kavi Aar. Attai Aar, Vaiyapadi Aar and Todai Aar. Its main tributary is the Killi Aar, which joins it at Nadakkara. Maintaining a south-westerly course throughout, the Karamana river empties into the sea near Thiruvallam. The length of the river is 68 km. It has a catchment area of 702 sq. km. The river passes through the outskirts of Trivandrum.

41. Neyyar: This is the southernmost river in Kerala. It originates from Agasthya mala at an elevation of about 1,860 m. above Mean sea level. From there it flows down rapidly along steep slopes in its higher reaches and then winds its way through flat country in the lower reaches. In the initial stages the course is in a southwesterly direction but at Ottasekharamangalam the river turns and flows west. It again takes a south-westerly course from Valappallikonam upto its fall.

The Neyyar is 56 km. long and has a total drainage area of 497 sq. km.

East flowing

The east flowing inter state river Kauvery has its catchment spread over the States of Karnataka. Tamilnadu and Kerala. Three of its main tributaries have their origin and initial reaches within Kerala. These are the Kabbini. Bhavani and Pambar: the three east flowing rivers of Kerala.

Kabbini river has its origin in the Western Ghat region of Wynad district and is fed by four important tributaries Panamaram. Manantoddy. Babali and Noolpuzha. These rivers have their origins at elevation above 1.350 m. The Kabbini in its course. demarcates the boundary of Kerala for a distance of 12 km. The total drainage area of Kabbini upto the point where it crosses the State boundary is 2.070 sq. km. of which an extent of 1.920 sq. km. is within Kerala

The Bhavani river. rises from Western Ghats at about 2,500 m. elevation in Nilgiri district of Tamilnadu. After an initial course of 13 km.. it enters the Kerala State and flows southward for about 29 km. upto Mukkali. Thereafter it takes a sharp and circuitous turn around the Malleswara peak. Beyond Mukkali the river flows almost north easterly till its re-entry into Tamilnadu at Kalkandiyoor. Its main tributaries within Kerala are the Siruvani and Varagar. The catchment area of Bhavani in Kerala is 562 sq. km.

The third east – flowing river. the Pambar. originates in Devikolam taluk at an altitude of 1950 m., above mean sea level. In its initial reaches. it is locally called Thalayar. It crosses into Tamilnad after tracing a course of 29 km. within Kerala. The main tributaries of Pambar are the Iravikulam. Myladi. Thirthamala. Chengalar and Thenar. The Thenar has a 12 km. flow path in Kerala and joins Pambar after crossing the borders to form the Amaravathi river. a tributary to Kauvery. The total drainage of Pambar including that of Thenar. within Kerala is 384 sq. km.

Kayals and Canals

There are twenty seven estuaries and seven lagoons within the Kerala region (Table 3) which are mostly interconnected by natural or man-made canals. The string of backwaters (Kayals). generally running parallel to the coast and having arms extending between the offshore bars occupy extensive area. The kayals are considered to be of three major categories on the basis of their Geomorphic and geological setting of the coastal plain. They are (I) those contained within the beach ridge complex area such as Vembanad and Kayamkulam kayals: (II) those occuring in the Warkalli terrain but have undergone some modification of morphology along the throats by growth of spits and (III) those occuring within the Warkalli terrain extending to the eastern margin of the coastal plain such as the Ashtamudi kayal. Of these the first category have their long axis running parallel to the shore line and are very narrow when compared to the length. Set well within the strand plain, these kayals are separated from the sea by large barrier spits interrupted by tidal passes. On the contrary the Ashtamudi kayal of the third category has its longest axis perpendic ıl ır to the shore. The margins of Ashtamudi kayal are fringed with dipping laterite hills of Tertiary age which are steadily wearing back due to human interference.

There is considerable fresh water inflow into the kayals from upland, particularly during the rainy season. When the rivers are at spate, the kayals overflow and discharge sizeable quantities of sediment into the sea. During the dry seaon, the sea water may tide up into the kayals for considerable distances. This result is seasonal fluctuations in salinity, rate of sedimentation and organic transport.

The important backwaters in the coastal tract contained within Kasaragode and Cannanore districts are Kumbla, Kalnad, Bekal, Chittari and Kavvai. Among these, the first four are the estuaries formed at the mouths of the respective rivers. The Kavvai kayal extends parallel to the coast for a distnce of 21 km. with outlets at the mouths of Karingote and Ezhimala rivers. Three other rivers viz., Peruvamba, Kavvai and Ramapuram

rivers also drain into this lake. There are a few islets (thuruths) in this kayal, the major ones being Madakkal, Edalakkad, and Vadakkekkad. To the south, this kayal is connected to Payangadi-Valapattanam rivers by Sultan's canal. The project for converting the northern outlet of this kayal into a minor fishing port is half-way on. Extensive made-lands is a peculiar feature around this kayal. Study of old maps reveal considerable narrowing of Kavvai kayal. The wide mouth of Valapattanam Payangadi rivers has been converted into a minor fishing port.

The Sultan's canal, about 3.2 km. in length is an artificial canal dug by Ali Raja (1766) when managing the Kolattiri domains for Hyder Ali. It connects Ezhimala river with the estuary of Payangadi Valapattanam rivers and can provide uninterrupted water communication at all seasons.

The Agalapuzha, literally meaning 'broad river', in Calicut district also may be considered as a kayal. This backwater extends to a north-south distance of 25.6 km., parallel to the sea upto its merger with the Elattur river close to its mouth. No significant rivers drain into it at present and nearly all the drainage from the Ghats at this point is intercepted by the main stream and tributaries of the Kotta river. It would seem as if the Kotta river had at one time found its way to the sea by this outlet instead of by the channel now in use and indeed even now the water level in the Kotta river sometimes rise so high as to threaten to breach through the narrow isthmus separating it from the Agalapuzha, the water-level of which rises of course much less rapidly in floods. This difference of level in floods necessitates the maintenance of a water-lock at the entrance of the Payoli canal from the Kotta river. The man—made Payoli canal of about 1.6 km. in length connects Agalapuzha to Kotta river.

Another important artificial water course in Calicut district is the Conolly canal, interconnecting the three rivers Elattur, Kallai and Beypur. It was imperfectly completed in 1848 as part of a scheme to extend inland navigation facilities available in Travancore area toward Malabar. The canal, cuts through several small ridges and hence is of irregular width. The Kallai estuary is wide enough to be treated as a small backwater.

There are two canals branching off from Bharathapuzha from near its mouth towards right and left. The canal on the right runs north upto Tirur. The leftward canal known as Ponnani canal runs south for a distance of 3.2 km. and connects itself with Velliankod kayal and runs further on upto Chettuvai river. This backwater system consists of a group of lagoons, the drainage of which is completely controlled by tidal action. Velliankod kayal is connected to Chavakkad kayal through narrow creeks. No stream of importance drains itself into either Velliankod system or Chavakkad kayal. Running about 24 km. the systems get connected to the sea in the south through Chetwai river.

The freshwater lakes Enamakkal and Manakkodi in Trichur taluk are interconnected and may be treated as a single system. Fed by the Karuvannoor, Viyyoor and Wadakkancheri rivers, the system extends over an area of 25 km². This system drains out into the backwaters through two narrow outlets at Enamakkal and Karamchira. Bunding at these points facilitates cultivation of paddy in the marginal beds of these lakes. Large scale reclamation has been effected following modern devices to check salt water incursion from the backwaters. The Muriyad lake in Mukundapuram taluk, which is much smaller in extent than the above is fed by several small streams and its surplus waters flow into the Karuvannur river during rainy seasons. It is brought under cultivation during the dry season. The irregular shaped marshy body, partly extending into Palghat district can hardly be considered a lake: and has been considerably narrowed down through reclamation and alteration into paddy fields.

Apart from Ponnani canal, there are three more navigation canals in Trichur district viz., the Conolly canal lying between Chavakkad and Mukundapuram taluks, the Shanmughom canal in Mukundapuram taluk and the Puthenthodu in Trichur Taluk. The Conolly canal, 12.8 km. long, connects Karanchira puzha with the backwaters at Vallivattom. The Shanmughom canal, branches off from Connolly canal and runs 7 km. long upto Irinjalakuda. Puthenthodu, the other canal connects Trichur to Karuvannur puzha.

There are two small backwaters in the Parur taluk of Ernakulam district; the northern one is the Kodungallur kayal and the southern one the varapuzha kayal. The Periyar falls in the Varapuzha kayal. A north to south canal of length 11.2 km. connects the villages of Cheranallur and Edapally in Kanayannur taluk. Another canal 8 km. long flows along the boundaries of Elamkulam and Ernakulam.

Although the Vembanad estuary has its mouth in Cochin, much of its extent lies ithin Alleppey district. Vembanad, the largest kayal in Kerala, extends from Cochin to Alleppey for a distance of 83 km. at widths ranging from about 15 km. to a few hundred metres. The area of this lake is approximately 205 km². Five important rivers viz., the Muvattupuzha, the Minachil, the Manimala, the Pamba and the Achankoil discharge their waters into this kayal. Draining a total catchment area of about 6,630 km². these rivers discharge about 5,61,000 MC ft. of water annually. The Vembanad kayal is bordered by the taluks Ambalapuzha and Shertallai of Alleppey districts and those of Vaikom, Kottayam and Changanacherry of Kottayam district.

The lowlands around the southern margins of Vembanad kayal have been extensively made into paddy fields through constructing bunds and pumping out the waters within. Since the tidal effect reaches upto the southern margin of the lake, the waters remain highly saline except in rainy season rendering Puncha cultivation unproductive. In order to prevent saline intrusion into the lake and the connected waterbodies further south, a bed-regulator across the neck of the lake connecting Thannirmukkom on the wet to Vechur on the east has been constructed. This regulator is the longest of its kind in India.

There are many islands and thuruths inside the Kodungallur-Vembanad kayals. The prominent among them are Willingdon island, Vaipin and Ramanathuruth. Cheria Kadamakudi. Ponjikara (Bolghathy). Vallarpadom. Valiakadamakudi. Kumbalam. Panangad. Cheppanam. Nettur. Pizhala. Kankattuthuruthu. Korampadom. Cheranallur. Chathannur. Pathiramanal. Pallippuram and Perumbalam are the other inlets of significance.

South of Vembanad is the 30.4 km. long Kayamkulam kayal. with an area extent of 59.8 km² from Karthikapally to Panmana. The shallow parts of this kayal have been altered into agricultural fields and the waterbody is considerably narrowed down. The Chavara—Panmana thodu connects it to Ashtamudikayal. It has a narrow outlet to sea at Kayamkulam.

The Ashtamudi kayal in Quilon district is unique in its configuration and extent. The name itself is derived from the fact that this backwater branches off into eight creeks, known by different local names. Running north from Quilon, Ashtamudi kayal is 16 km. long while the total width is about 15 km. Average width of individual creeks is around 3 km. The Kallada river empties through this kayal. The outlet to the sea is at Neendakara, which now been protected as a fishing port. A bridge 408.6 m. (1338 feet) long spans the backwater to the east of Neendakara.

South of Ashtamudi, there is a small but deep backwater known as Paravur kayal. Its outlet to sea is often hindered by sand bars. The Ithikara river empties into this kayal. The Kollamthodu connects Paravur kayal to Ashtamudi. Another one the Paravur thodu likewise connects it to the Edava and Nadayara kayals to the south. These two small kayals lying partly in Trivandrum district are also separated from the sea by sandbars which are cut only in rainy season. A chain of Kayals interconnected by man-made canals run down to Trivandrum faciling inland navigation along the coastal zone. This waterway, if properly repaired and maintained would provide a straight route from Trivandrum to Tirur. The kayals in Trivandrum district from north to south are Anjuthengu, Kadinamkulam and Veli. These are comparatively small and shallow. To provide an uninterrupted water way two tunnels have been constructed across the Warkalli cliffs of lengths 283 m. and 721 m. respectively.

FRESH WATER LAKES

Besides the above backwaters there are a few freshwater lakes in Kerala. The southernmost of them is the Vellayani lake south of Trivandrum. The Sasthamkotta lake in Quilon

district is the only major freshwater lake in Kerala. It is situated on the right bank of Kallada river. The lake is surrounded by high ridges in all the three sides and is protected on the east by an earthern bund, about 1.6 km. in length. Althugh the areal extent is small (3.7 km²) the lake is generally deep, the maximum depth being 14.3 m. There is no stream draining into this lake.

In south Wynad, there is small waterbody called Pookkot lake which is perennially full.

The shore

The 560 km. shore lines of Kerala with a generally straight configuration has a number of offsets towards east and the major ones are at Kotekunnu north of Azhikkal and Kadalur south of Badagara. These are due to faults. Between Kotekunnu and Alleppey the coastline moves inward into the land. The concavity of the coastline may be related to the structural feature and also to the resistance of rocks exposed to the high wave action during the South West monsoon in this region. The curved coastline of Kerala is exactly in North East direction of ninth degree and eighth degree channels between Laccadive and Maldive islands.

Out of the 560 km. of total coast line, about 360 km. in different reaches is subject to active erosion. Raju and Raju (1982) have estimated a net loss of 600 m. wide belt of coast during the last 120 years, on account of erosion.

The chain of Kayals admixed with the estuaries formed at the mouth of the rivers retain a perennial waterbody almost parallel to the shoreline. Heavy tidal inflow during monsoon and other tidal peaks result in the breaking of the narrow sandy ridge between these water columns and the sea. Likewise during dry seasons the existing openings may be barred by accumulated sediments. Tidal action may thus result in breaking and building up of sand bars which in turn may cause considerable changes in the total configuration of the coastline.

Apart from these minor phenomena, the coastline might have been subjected to serious alterations through river channel changes. Geomorphological observations have revealed shifting of river mouths by long distances in considerably short periods. The coastal stretch, generally occupied by sand bars and spits, intervened in many a place by overhanging cliffs and sub-parallel rock ridges manifest a compound aspect of submergence and emorgence

The rock exposures and cliffs along the coastline are of 3 to 29 metres in elevation. The cliffs are invariably capped by laterites and are made up of incoherent sedimentary formations downwards. Because of this they are subject to heavy undercutting, resulting in profile recession. Close scrutiny of satelliteimageries covering the area suggest that these cliffs as well as the sub-parallel rock ridges might have evolved as the result of NW-SE and N. N. W.-S. S. E. fractures.

The rock-ridges close to the shoreline may be considered as remnants of erstwhile sea cliffs. Hardly above water level these ridges are seen to extend into the shelf area sloping westward to limits not yet determined. On the shore front where they appear to be protruding rock-ridges, metamorphosed sedimentaries are in prominence but the subaqueous parts constitute laterites which are characteristically reddish brown.

Early writers like Strabo (A. D. 19) and Pliny, the elder (A. D. 77) have mentioned about several minor ports like Musiri, Tundi, Naoura and Nelkunda, as to have been, situated on the Kerala coast. The anonymous author of the 'Periplus of the Erythrean Sea' (A. D. 80- -89) has furnished many details about these ports, which were flourishing in trade and other tertiary activities. These ports have however lost their identity and are left untraceable now. Historians have been trying to locate these ports all through, but have not yet succeeded in fixing them. The references about these ports contain stadia distances between one port and another as well as other physical and cultural identifications. The classic literature in Tamil has gone a step ahead indicating the Geomorphic unit (tinai) in which these places were situated. In spite of all these hints the historians have not arrived at a consensus in locating them.

Table I

MOUNTAINS AND PEAKS IN KERALA

(From North to South)

Sl. No.	Name of Peak	Height in metres
1.	Veidal mala	1371
2.	Brahmagiri	1608
3.	Banasura mala	2061.0
4.	Neduvaram	1389
5.	Tanotemala	1553
6.	Kurichipandi	1606
7.	Elambileri	1838
8.	Manikunnu	1374.0
9.	Vellara mala	2244
10.	Vavul mala	2338
11.	Makurit	2554
12.	Anginda	2386
13.	Karimala	1998
14.	Kalladikod	1219
15.	Padagiri	1585
16.	Karimalagopuram	1439
17.	Vellachimudi	1219
18.	Valiyavanam	1219
19.	Myammudi	1219
20.	Kanchilakunnu	1204.57
21.	Mukkottumudi	1203.0
22.	Virappillikunnu	1222
23.	Mudian Para	1217.98
24.	Vantholam mala	1231.39
25.	Anamudi	2817.06
26.	Sholea mala	2698
27.	Devi mala	2643
28.	Coorca Comboo	2132

29.	Chockenmudy	2224
30.	Perumputty	1981
31.	Vagavarai	2560
32.	Allimala	2103
33.	Eravimala	2381
34.	Kattumala	2590
35.	Kumarikal	2575
36.	Chemmunmundi	2163
37.	Payratmala	2254
38.	Korumpara	2529
39.	Pambadumchola	2560
40.	Sabari mala	1155
41.	Pamba mala	1179
42.	Meem mala	1734
43.	Koyil mala	1601
44.	Alasi mala	1456
45.	Changu mala	1556
46.	Sivagiri mala	1744
47.	Pala mala	1502
48.	Kakkiar mala	1228
49.	Velakalli mala	1165
50.	Agasthyamudi	1869

Table II

RIVERS IN KERALA (West flowing)

Sl. No.	name of river	Length (Km.	Catchment area (Km.^{2})	Run off 1000 MC ft.
1.	Manjeswar	16	90	3.0
2.	Uppala	50	250	20.0
3.	Shiriya	67	587	43.0
4.	Mogral	34	132	91.5
5.	Chandragiri	105	1406	110.2
6.	Chittari	25	145	7.0
7.	Nileswar	46	190	16.5
8.	Karingode	64	561	50.36
9.	Kavvayi	31	143	6.87
10.	Peruvamba	51	300	23.6
11.	Ramapuram (Ezhimala)	19	52	2.79
12.	Kuppam (Payangadi)	82	539	44.7
13.	Valapattanam	110	1867	97.7
14	Anjarakandy	48	412	8.7
15.	Tellicherry	28	132	4.8
16.	Mahe	54	394	18.2
17.	Kuttiadi (Kotta)	74	583	46.98
18.	Korapuzha	40	624	58.7
19.	Kallai	22	96	7.2
20.	Chaliyar (Bepur)	169	2923	185.0
21.	Kadalundi	130	1122	77.3
22.	Tirur	48	117	9.5
23.	Bharathapuzha	209	61876	311.8
24.	Keecheri	51	401	16.0
25.	Puzhakkal	29	234	N.A.
26.	Karuvannur	48	1054	42.0
27.	Chalakudy	130	1704	42.0

28.	Periyar	244	5398	434.8
29.	Muvattupuzha	121	1554	93.68
30.	Meenachil	78	1272	96.27
31.	Manimala	90	847	72.67
32.	Pamba	176	2235	222.796
33.	Achen coil	128	1484	76.0
34.	Pallickal	42	220	N.A.
35.	Kallada	121	169	76.0
36.	Ithikkara	56	642	42.0
37.	Ayroor	17	66	N.A.
38.	Vamanapuram	88	687	52.08
39.	Mamom	27	114	N.A.
40.	Karamana	68	702	38.75
41.	Neyyar	56	497	29.6

Table III

LIST OF ESTUARIES AND LAGOONS IN KERALA

I. Estuaries

1. Uppala
2. Kumbala
3. Mogral
4. Chandragiri
5. Kalnad
6. Bekal
7. Chittari
8. Karingote
9. Ezhimala (ramapuram)
10. Valapattanam
11. Dharmadom
12. Tellicherry
13. Mahe
14. Kottakkal
15. Elathur
16. Kallai
17. Beypore
18. Kadalundi
19. Chettuvai
20. Ponnani
21. Vembanad
22. Kayamkula
23. Asthamudi
24. Paravur
25. Edava-Nadayara
26. Kadinakulam
26. Kadinamkulam
27. Veli

II. Lagoons

1. Kavvayi
2. Agalapuzha
3. Enamakkal-Manakkodi
4. Muriad
5. Kodungallur-Varapuzha
6. Sasthamkotta
7. Vellayani

GEOLOGY

The State of Kerala forming the South Western fringe of Indian Peninsular Shield is geologically composed of four major types of rocks:

1. Crystalline rocks of the Precambrian age rocks which are 600 to 3,800 million years old.

2. Sedimentary rocks of Tertiary (Cenozoic) age-rocks younger than 65 million years (m.y.).

3. Laterite derived from the chemical weathering of the rocks mostly during the Pleistocene period (2 m.y.) occurs as capping and blanket type of rocks over the crystalline and sedimentary rocks.

4. Recent to sub-recent (10,000 years before present) sediments occupying the low-lying areas and river valleys.

1. Rocks of the Precambrian Age

These complex crystalline rocks are of igneous and metamorphic origin. Mainly they are exposed in the Western Ghat ranges and their foot hills, to a lesser extent in the midland region, and infrequently in the coastal region. Some of the metamorphic rocks which have developed gneissic structure may be of igneous origin while other metamorphic rocks, finely foliated and contorted, may be of sedimentary origin. The Precambrian crystalline rocks comprise chiefly the khondalite group, the charnockite group, complex gneissic rocks, the highly metamorphosed schistose and ultrabasic rocks of Wynad (Wynad Schis Complex), isolated outcrops of less metamorphosed sedimentary rocks of Vengad in Cannanore district (Vengad Formation), granite and granite-like rocks and gabbros (younger intrusives) all of which are traversed by quartz and pegmatite veins of acidic composition and dykes of basic chemical composition.

The Khondalite group

The Khondalite group of rocks includes garnet-sillimanite-

biotite gneiss with graphite, and garnet-biotite gneiss with minor lensoid bodies of calc granulite and quartzite which are light-coloured, fine to medium-grained, foliated and granulitic. This group of rocks traversed by narrow zones and bands of charnockitis rocks make up the greater part of the country in South Kerala, more particularly in Trivandrum and Quilon districts. Lenticular bands of crystalline limestone and calc granulite occur interbanded with these rocks in the districts of Palghat, Idukki, Quilon and Trivandrum.

The Charnockite Group

The Charnockite group consists of pyroxene granulite, charnockite, gneissic charnockite, magnetite-quartz rock and charnockite gneiss containing the mineral cordierite. Of these, the charnockite and gneissic charnockite are the most widespread rock types of Kerala and occypy nearly 50% of the total area of the State. They occur almost in all districts, They are bluish grey to dark coloured rocks, granulitic and gneissic in texture. They are characterised by the presence of minerals—quartz, felspar and a rhombic pyroxene (hypersthene). In many a place, these rocks have been metamorphically downgraded giving rise to hornblend and hornblende-biotite gneiss. These rocks contain several bands of magnetite-quartz rock (magnetite quartzite) in Kozhikode, Palghat and Malappuram districts. Pyroxene granulite occurs as lensoid and ovoidal remnants, and also as dyke-like forms within the charnockitic country rocks. Due tocertaintectonic effect, a mineral cordierite (cyclosilicate of aluminium, Magnesium and iron) is also seen to have developed in the charnockitic gneiss along some regional fracture zones in the Quilon, Trivandrum, Alleppey and Kottyam districts.

Complex gneissic rocks (Migmatitic gneisses)

Migmatitic gneisses rank next to charnockites in so far as the preponderance is concerned. They contain quartz, grey and pink felspars, and dark minerals such as hornblende and biotite. They exhibit various migmatitic structures 9wavy, banded, eye like structures etc.,) developed due to plastic deformation of the quartz and felspar generated during the partial melting of deep crustal rocks. Migmatitic rocks are quite common in the State; however, their spectacular development is noticeable in Wynad, Palghat and Idukki districts.

Wynad Schist Complex

These rocks occuring as narrow arcuate belts and lenses within the charnockite and migmatite gneise are best seen in Wynad and Cannanore districts. These include rocks like garnet-sillimanite-kyanite gneiss, quartz-mica schist and quartzite with mica, kyanite, sillimanite and magnetite, and ultrabasic rocks now seen as tale-tremolite-chlorite schist. All these rock types have undergone intense deformation, high grade metamorphism and migmatisation. This Schist Complex is considered as equivalent to the Sargur Schist Complex of the Southern Karnataka.

Vengad formation

The rocks of this formation occur in parts of Tellicherry taluk in Cannanore district. Though their occurrence is very much restricted, they deserve mention because of their correlation with the geologicaly renowned rocks of Dharwar Super Group of Peninsular India. The formation includes conglomerate, quartz-mica-schist and quartzite. Their identity differs from the Wynad Schist Complex by the presence of primary sedimentary structures (curreht and graded bedding) and by the effects of low grade metamorphic features

Younger intrusive bodies

The younger intrusive bodies conceived to be of late Precambrian times are distinguished as separate bodies within the rocks described above. These include granite, granophyre, syenite, diorite, gabbro and anorthosite. Pink and grey granites occur at Munnar (Idukki district), Kalpetta and Ambalavayal (Wynad district) and, Piralimala and Angadimogaru (Cannanore district). Granophyre (a textural variant of granite) is noticed at Ezhimala, Cannanore district. Syenite and its variants (a variety of granite, deficient in silica) are recorded at Chengannur (Alleppey district) and Sholayar (Trichur district). Diorite an intermediate rock mainly containing plagioclase felspar, hernblende and subordinate quartz occurs around Begur in north Wynad. Massive gabbro bodies are documented from Adakkathode in Cannanore district and Karthikulam in Wynad

district. This coarse grained rock contains almost equal amounts of plagioclase felspar and pyroxenes. Anorthosite, almost a monomineralic rock in composition (calcic-plagioclase) which is a coarse-grained plutonic igneous rock occur at Perinthatta in Cannanore district and Attappadi, Palghat district.

Quartz and pegmatite veins

There are numerous quartz and pegmatite veins traversing the crystalline rocks described above throughout the State. Pegmatite is coarse-grained and normally contains quartz and alkali felspar besides dark minerals like biotite mica and metallic ore minerals.

Basic dyke rocks

A number of basic dykes of dolerite and gabbroic texture are seen cutting across the crystalline rocks of the State. Principally the rock is composed of plagioclase felspar and pyroxenes often with subordinate amounts of olivine or quartz., They mostly trend (parallel or sub parallel to the coast line on the west) in NNW—SSE— and NW—SE directions. Though it is thought that a majority of the dykes belong to late Mesozoic—Early Tertiary period, at least a few of them may belong to late Precambrian period.

2. Sedimentary rocks of the Tertiary (Cenozoic) age

The Tertiary sediments of Miocene age consists chiefly of a series of variegated sandstones and clays with lenticular seamlets of lignite, known as Warkalli beds. These are underlain by more compact sand and clay with shell fragments and thin bed of limestone called Quilon beds. The Warkalli beds mostly extend in a narrow belt from Trivandrum to Kasaragod between coastal and midland regions with intervening promontary of the crystalline rocks. The Quilon beds are mostly known to occur at Paravur, Padappakkara and other places around Quilon. The limestone carries fossil remains such as gastropods, lamellibranchs, corals, pelicipods foraminifera and ostracods besides being rich in floral remains.

A significant area in Alleppey and Ernakulam districts has its sub-surface geology marked by great thickness of the sedimentary rocks belonging to the above age. The thickest sequence occurs around Ambalapuzha in Alleppey district.

3. Laterite

This rock type occurs extensively throughout the midland and coastal regions of the State more conspicuously in the Malabar region. It is of interest to note here that the term *laterite* was coined by a Scottish Medical man, Francis Hamilton Buchanan during 1800 after observing this curious looking rock type from Angadipuram in Malappuram district. Geological Survey of India has erected a National Geological Monument at this place to commemorate this discovery in 1979*

Laterite, commonly used as a building stone in the State, occurs as cappings over the crystalline and sedimentary rocks with thickness varying from a few metres to 50 m. This pox-textured rock, figuratively described as one which is developed due to affiliction of cancer to the host rocks, is a product of deep chemical weathering of rocks during a prolonged period of exposure to the tropical climate in tectonically stable regions.

* See Addenda II

4. Recent to Sub recent sediments

Sub-recent to recent sediments consisting of great thickness of coastal sands, sticky black clays, beds of carbonised wood and silty alluvium and lagoonal alluvium are seen mostly in the low-lying areas of the State fringing the Lakshadweep sea. The distribution is at its widest between Alleppey and Kottayam almost to an extent of about 25 km from the shore line.

The coastal sands can be categorised into different types based on the colour such as yellow, grey, white and black sands, the last two being of economic importance. The sticky black clay is seen in and around the lagoons *(Kayals)* between the shore line and midland regions of the State, typically seen in

the Kuttanad area, Alleppey district.. At a number of localities around the southern portion of the Vembanad lake it has been observed that there are submerged tree trunks embedded in clayey matrix which could possibly indicate the existence of a forest in the recent geological past. Silty alluvium and lagoonal alluvium have been deposited in the seasonally flooded areas of the coastal districts.

In addition to the above sands, alluvium and pebble beds are profusely distributed along the major river valleys of the State.

Structure

The regional strike of the Precambrian crystalline rocks of the State is NW—SE to NNW—SEE. Towards the eastern and south eastern part of the State, the strike trends almost E—W Minor variation to NE—SW strike trend is also observable in the region lying close to Nilgiri hills. The Tertiary rocks are almost horizontal to sub-horizontal.

The Precambrian rocks are folded in different geometric styles involving several stages of deformation. Most prevalent of the fold styles, are the regional isoclinal antiforms and synforms in an E—W axis. Other styles of folds are asymmetric antiform and synform of sub regional nature, and tight folds of mesoscopic scale and open warpings in near N—S axis.

There are broadly five sets of major lineaments including prominent fractures, joints, shear zones and fault planes noticeable in the State. These trend in (1) E—W to WNW—ESE; (2) NNW—SSE; (3) NW-SW; (4) NE—SW; and (5) N—S direction. E—W to WNW—ESE fractures are the oldest and are deep crustal. These include Bavali lineament in Cannanore and Wyand districts, Bhavani lineament in Palghat district, Periyar lineament in Idukki and Ernakulam districts, Achankovil lineament in Quilon and Alleppey districts, and Tenmalai lineament in Quilon district. The NNW—SSE and NW—SE sets of lineaments (mostly mega—fractures) are thought to be of relatively young geological age and are in a way responsible for the present configuration of the west coast. Most of the dyke systems

have been emplaced along these fractures e.g. Muvattupuzha and Idamalayar dykes.

Metamorphism

The process of minerological and structural changes that take place in a solid rock under changed temperature and pressure conditions (brought forth by deep burial, compressive forces acting within the earth, etc.) is called metamorphism. The grade of metamorphism can be indentified on the basis of certain diagnostic and characteristic mineral assemblages and textures.

The khondalite and charnockite group of rocks have undergone the highest grade of metamorphism called the granulite facies. Those rocks belonging to Wynad Schist Complex have been subjected to upper amphibolite grade of metamorphism.

Geological Evolution

During the Precambrian epoch, the geological events that took place in the region in general, were esentially a part of crustal thickening and formation of the shield, as happened elsewhere in the earth. During this part of geological timescale (3,800 to 600 m.y.), the region witnessed three important sedimentary cycles concomitant with basic volcanic activities, metamorphic deformation and fracturing. These early sedimentary cycles, consequent upon attaining higher grade of metamorphism were punctuated by the injection of migma produced by partial melting of the rocks giving rise to different types of migmatitic gneisses. As the region was attaining stability in the later parts of the Precambrian, Magmatic bodies such as granite, syenite etc., were emplaced in them.

During the Palaeozoic and Mesozoic eras, the evolutionary imprint recorded so far in the region is almost nil; perhaps this part of the shield was then continuously contributing sediments to basins elsewhere in the Indian Peninsula.

After the Precambrian epoch, the next noticeable tectonic

event of this region is the development of NNW/NW fractures during the late Mesozoic early Tertiary period, coinciding with the global event of continental break-up of the Gondwanaland. These fractures were mostly responsible for the west coast faulting. The basic dykes found channel ways through these fractures. After this event, isolated to partly interconnected basins came into existence all along the coastal region. In these basins, the Tertiary sediments (mostly of mio-pliocene age) were deposited. There were, in stages, upliftment and marine transgression and regression in several areas along the coast during this period. Closely on the heels of this episode, the processes of lateritisation commenced (during pleistocene). In the Quaternary period several sand bars parallel to coastline were developed which are manifest as present day sands of the coastal region.

Mineral resources

Kerala, though not very rich in mineral resources, has a prolific source of a few minerals obtained from the beach sands such as ilmenite, rutile and monazite. Other minerals which are being actively exploited are different varities of clays, limestone, limeshell and silica sand. Occurrences of bauxite, graphite and iron ore in economic quantities; so far they remain untapped.

A brief account of various economic minerals of the State is given below :

Allanite :—Allanite was found to be present in small pegmatite veins in charnockite gneiss north of Puthiyamuthur and in pyroxene granulite in Sholayar dam area in Trichur district. This mineral is also noted to occur in Peralimala granite in Cannanore idstrict.

Amazonstone :—Amazonstone, a green variety of felspar occurs in Ambalavayal granite, Wynad district.

Amethyst :—This violet coloured transparent quartz is known to occur in pegmatite veins in a number of localities in Idukki

district and in sheared pegmatite at Nellikala. Quilon district.

Amber :—Amber locally called *Kallinji*, a fossiliferous resin, occurs frequently with the carbonaceous clay and woody horizons in Alleppey and Kottayam districts.

Bauxite :—Bauxite, the chief ore mineral of aluminium occurs as pockets within laterite. Important deposits are located in cannanore, Alleppey, Quilon and Trivandrum districts.

Cannanore district :—Kumbala prospect has an average Al_2O_3, of 43% and ore reserve is about 1.82 million tonnes. Nileswar bauxite deposit is the biggest deposit in Kerala with a reserve of 6.1 million tonnes containing 48 to 50% Al_2O_3

Taliparamba :—prospect occuring at Pattuvam and Madayi has a reserve of 1.53 million tonnes whereas the Kanhangad deposit has a reserve of 0.71 million tonnes.

Quilon and Alleppey districts :—The prospects are small in these districts but contain higher Al_2O_3 value (48 to 50%). Important deposits with their reserve in million tonnes in parantheses are Sooranad (0.89), Vadakkumuri (0.98) and Adichanallur (0.26).

Trivandrum districts :—The bauxite prospects of Trivandrum district are rich in silica. A total of 0.93 million tonnes of bauxite occur in different localities of Mangalapuram, Chilampil, Sasthavattam, Ambalam and Attipara.

Minor occurrences, of bauxite in Malappuram district are recorded from Kottakkal, Parappur, Volakkara, Uragam, Melmuri, Chappanangadi and Cherusola: in Trichur district at Mattan near Guruvayur and near Alur; in Alleppey district at Peringara and Arikkara; and in Trivandrum district at Karicha and Aakulam.

Clay :—The State has vast resources of different varieties of clays like china clay (kaolin), ball and fire clay, and brick and tile clay. These types are of both residual and sedimentary origin.

China clay (Kaolin) :—Kerala has a reserve of about 58.64 million tonnes of china clay, which accounts for 25% of the country's known potential. The chief deposits are in Cannanore, Ernakulam, Quilon and Trivandrum districts.

Cannanore district :—In Cannanore idstrict, the china clay occurs at the base of Tertiary rocks. Important occurrences are seen at Nileswar, Kalanad, Mulinja, Payyangadi, Ramapuram, Kannapuram, Chovva, Chimeni and other places. Recorded potential of the Cannanore district is 6.64 million tonnes.

Ernakulam: The clay deposit is known from Trikkakara, Mulanthuruthi, Amballoor, Kanjiramattam, Manjummel and other Places. The known reserve is of the order of 2.5 million tonnes.

Quilon: The best known china clay deposit is from Kundara in this district. Other deposits are located at Chathannur and Mulavana.

Trivandrum: In Kazhakuttam, Thonnakkal, Aakulam, Arumanur, Pallipuram, Chilampil, Azhoor, Kulamuttam and in other places, china clay is noticed in the district. 5.44 million tonnes of clay has been estimated in the district.

Other occurrences of china clay are known at Chalakudi, Kizhupullikara etc. in Trichur district, Payimbra in Calicut district and in Mookuthala, Kaithaparamba and Mukkali in Palghat district.

Ball and fire clay: Sedimentary rocks cropping out along the Kerala coast contain several beds of ball and fire clay which are suitable for refractory industries. These are worked out mainly from Cannanore, Ernakulam, Alleppey, Quilon and Trivandrum districts. A total of 10 million tonnes of fire clay and 2 million tonnes of ball clay are believed to be available in these districts.

Cannanore district: Ball clays occur at Patuvam, Karivellur, Eripuram and Payangadi areas.

Ernakulam district: Occurrences of fire clay are located at Amballur. Kanjiramattam and other areas.

Alleppey: Thamarakulam area has a fire clay deposit.

Quilon district: Ball clay and fire clay deposits are seen at Kumbalam. Kanjirakattuseri. Kundaman. Velichikala and other places.

Trivandrum district: Ball and fire clay deposits are seen at Kazhakuttam. Pallipuram. Nadayara and other areas.

Brick and tile clay: There are a number of occurrences of tile clay in the State which support tile industry. Those worth mentioning are at Feroke in Calicut district. Chalakudi. Ollur and Ambailur in Trichur district. Alwaye and Angamali in Ernakulam district and at Quilon. At a number of places throughout the State, brick is made from brick clay. The brick and tile clay are mostly of alluvial origin.

Corundum: A mineral valued as an abrasive and gemstone. Corundum occurs at the contact of metamorphosed ultra-basic rocks with the magmatitic gneisses in Maddaru area (Sultan's Battery) Wynad district. It is also seen as rare crystals within the ultrabasic rocks of Sreekandapuram area and in pegmatite veins at Perla area in Cannanore district.

Chalcopyrite: An ore mineral of copper occurring in small quantities which are not of economic value has been reported from Vadavathur. 5 km. east of Kottayam. in auriferous quartz veins of Wynad and Malappuram districts and in granitic and pegmatitic bodies almost throughout the State.

Galena: Galena is reported from Attapadi area. Palghat district.

Glass Sand : White silica sands occuring extensively along a 35 km. long Alleppey-Shertallai-Panavally tract, is used for the manufacture of glass and as foundry sands. The total reserve estimated is of the order of 60 million tonnes around Varanad, Maruthoorvattom, Pallippuram and Panavalli areas. Minor occurrences are also noticed in Ernakulam and Trivandrum districts.

Gold

Primary Gold : Primary gold is noticed in very small quantities in the auriferous quartz reefs of Chundale, Vayittiri, Tariode and Manantoddy areas of Wynad district and Nilambur area of Malappuram district. They form the western part of the Wynad Gold Field.

Placer gold : There are two main zones of auriferous gravels in the Nilambur valley of Malappuram district namely : (1) Pandipuzha—Chiyarpuzha zona and; (2) Punnapuzha—Maradipuzha zone. Gold is associated with finer sand occupying the interstices between the bigger gravels or in the lateritic matrix. A possible reserve of about 8.5 million cu.m of auriferous gravels is estimated in the area.

Very minor occurrences are also known fron siruvani river in Attapady valley, Puliseri and Pottaseri in Palghat district and from sands of river near Cranganore in Trichur district.

Graphite : Graphite is found in workable quantities mainly in association with the khondalite group of rocks in Trivandrum, Kottayam, Quilon, Ernakulam and Idukki districts. It is also seen in Charnockite group of rocks of the southern and central districts of the State which of no economic significance.

Ernakulam and Idukki districts : Thodupuzha and Muvattupuzha areas of these districts constitute probably the biggest graphite bearing belt of the State. Here Vadakod, Nagapuzha and Manakad deposits together have a reserve of nearly 6.50 million tonnes of graphite. The belt is also includes minor deposits like Peralimattom, Perungala, Nirampuzha, Paik and Karimukal.

In addition to these. Thekkumbhagam and Kajumolare in Alwaye taluk have a reseve of 1.3 million tonnes tonnes of graphite.

Kottayam District : Occurrences of graphite in the Kottayam district are known from Chirakkadavu, Aranikunnu, Velavur. Idanad Kallambakka, Vazhur, Puvarani, Idamala, Chelavu and near Idayar. At Chirakkadavu area, the inferred reserve of graphite is about 0.7 million tonnes.

Quilon District : The eastern parts of the district, have occurrences of graphite at Karuppanthode and Changapara (near Punalur) areas, of which the former contains 3,500 tonnes of graphite. Other occurrences are also known from Kilikollur, Ranni, Pallickal and Ittamuzhi.

Trivandrum District : The graphite occurrences of the district are well known from Changa, Vellanad, Kuttichal, Karuppur, Puliyarakonam, Chengallur, Karanakodu, Vengannur, Amaravila, Veli and Kizhattingal. Changa and Vellanad area have a probable reserve of 3000 tonnes.

Gemstones: **A variety of gemstones have been recorded from almost all parts of the State. Mostly semiprecious stones are seen included in either pegmatite veins or in gravels. Chrysoberyl is the only gemstone of economic value: the rest like amethyst, ruby, sapphire, garnet, jasper, topaz beryl and quartz crystals are of academic interest.**

Chrysoberyl (an aluminate of beryllium) and its subtypes like Alexandrite and Cat's eye are chiefly reported from Trivandrum and Quilon districts. Important localities are around Neyyattinkara, Vellanad, Nedumangad and Venjaramud in Trivandrum district and from Kottarakara area in Quilon district. Further sediments of rivers like the Karamana, the Vamanapuram, the Killi and the Kulathupuzha are known to contain fragments of these semi—precious mineral.

Ilmenite, Rutile and Monazite: **The beach sands of Kerala coast particularly of Quilon district contain important minerals of Titanium (ilmenite and rutile) and atomic mineral (monazite).**

besides several other minerals like garnet, sillimanite, zircon and magnetite.

The occurrences of large quantity of ilmenite and monazite are reported from Neendakara, Chavara and Kozhithottam areas of Quilon district and are exploited in this district.

Concentration of these minerals in the beach sands is also observed at Vizhinjam, Kovalam, Pachallur, Varkala and Veli areas of Trivandrum district; Balanged to Ponnani in Malappuram district, around Kumbla in Cannanore district, between Beypore and Kallayi rivers in Calicut district and around Chowghat in Trichur district.

Iron ore: There are several known occurrences of iron ore in Kerala. These are mostly seen as magnetite—quartzite. The important deposits are in Calicut and Malappuram districts.

In Calicut district, there are five major deposits at Cheruppa, Eleyettimala, Nanminda—Naduvallur, Alampara, East hill and West hill of Calicut. From these deposits, a total reserve of 79 million tonnes has been indicated out of which 37 million tonnes is "oxidised" ore (lying within a depth of 40 m from surface) and 42 million tonnes is "unoxidised" ore (lying in the deeper parts). In the Malappuram district, Korattimala deposit contains 1.86 million tonnes of oxidised ore and 2.52 million tonnes of unoxidised ore.

Other occurrences of magnetite quartzite are reported from Nilambur, Kalikavu, Chembrasseri and Manjeri in Malappuram district, numerous thin bands in Attapadi, Mannarghat and other areas of Palghat district; and Rendar and Eranalu in Kottayam district. Lateritic iron ores are known from Cherukunnu in Cannanore district, Mulavana and Nellitti in Quilon district.

Kyanite: Transparent to translucent crystals of Kyanite are known to occur at Chovva and Kathirur in Cannanore district and Kyanite lumps in laterite are known near Iritty area of Cannanore district. Minor incidences are also noticed in pegmatite veins near Vadanam in Quilon district.

Kankar: Kankar occurs at several places in Chittoor taluk of Palghat district. 3.5 million tonnes of kankar is believed to be available here.

Limeshell: Limeshell locally known as 'Kakka' in Malayalam occurs extensively in the 'kayal' sectors of the State.It is used mainly in white cement, brick and 'Chunam' (lime) manufacture. Important occurrences are described below: —

Alleppey — Kottayam — Ernakulam districts

The Vembanad lake occupying a part of these districts forms the biggest source of limeshell in the State. Limeshell is seen around Thannirumukkam, Pathiramanal, Vaikom, Kulasekharamangalam, Kumarakom, Panavalli, Kainakary, Mathilbhagam and Chembamuri.

Quilon district: Ashtamudi kayal, Paravur kayal and other lakes of the district contain limeshells similar to those of Vembanad kayal.

Trichur district: Limeshell occurs at Chowghat, Crangannore and Karinchira areas.

Malappuram district: Shell horizons occur at Ponnani.

Calicut district: Limeshells are noticed north of Kadalundi, Korapuzha and Murat rivers and also at Ayalapuzha area.

Cannanore district: Occurrences of limeshell are noted around Payyannur, Udumbanthala, Cheruvathur, Nileshwar, Kanhangad, Valapattanam, Tellicherry and other places.

Limestone: The recorded major occurrence of crystalline limestone is from the Pandarettu area in Walayar Reserve Forest of Palghat district. A total of about 23 million tonnes of limestone have been estimated upto 300 m. depth of which 17 million tonnes have been assessed as mineable.

Minor deposits and bands of crystalline limestone are also

reported from Vannamadai, Chavadipara, Nettungangai and Kozhinjampara in Palghat district and Yellappatti Estate area near Munnar in Idukki district.

Limestone of sedimentary origin is exposed at Padappakara Kondalasheri, Nedungolam, Niravillasseri, Kottiyam, Mayyanad and other areas in Quilon district.

Magnesite: Magnesite has been recorded as small lenses in the Attappadi valley, Palghat district.

Marcasite: Nodules of marcasite, an unstable mineral of iron sulphide, occurs frequently associated with clay horizons of Warkalli beds.

Mercury: Mercury is alleged to occur in the native state, as minute globules in laterite on the northern bank of Murat river near Badagara in Calicut district.

Mica: Muscovite (white), Phlogopite (brown) and biotite (black) are the most common mica minerals noted in the State. Of these, phlogopite mica, once mined at Kakappunnu area, near Punalur, Quilon district is worth mentioning. Other types are mostly recorded on a small scale as flakes in pegmatite veins, almost throughout the State.

Molybdenite: *Two occurrences of molybdenite (a disulphide of molybdennum) have been reported very recently by Geological Survey of India in the State from Ambalavayal granite of Wynad district and from Chengannur syenite near Kozhenchery of Pathanamthitta district. Stray incidences of this mineral are also reported from charnockite rocks of Idukki and other districts.*

Peat and Lignite: Peat and lignite are known to occur as thin beds/seams in the Tertiary sedimentary rocks of the State. They are chiefly reported from Pathirappalli, Thottappalli, Tagazhi and around Tamarakulam in Alleppey district; Cannanore town, Peralam, Kadankotemalan, in some coastal areas of Kasargod taluk in Cannanore district; around Varkala in Trivandrum district, Paravur, Arikara in Quilon district and Beypore river section south of Calicut in Kozhikode district and Trippunithura in

Ernakulam district. Decomposed wood also commonly occurs in the Kuttanad area of Alleppey district.

Pyrite: Pyrite popularly called 'fool's gold is an iron sulphide occuring scantily almost throughut the state in the crystalline rocks and also in a few quartz and pegmatite veins. They are not of economic significance.

Pyrrhotite: Pyrrhotite, sulphide of iron, is reported to occur in the Punalur mica mine area of Quilon district and has not been found to be of any importance.

Scheelite: An ore mineral of tungsten, Scheelite is found in very small amounts in the river sands of Siruvani river and its tributaries of Attappadi valley in Palghat district

Sphene :—Sphene, silicate of calcium and titanium, is found as crystals in the eastern part of the Peralimala granite in Cannanore district.

Steatite[soap stone[talc:—Steatite a rock made up of talcose minerals (hydrous magnesium silicate) are seen as bands in Sultan's Battery area of Wynad district and around Nallore and Sreekantapuram of Cannanore district.

Geological antiquities and geology related processes

Old mines : Old workings for exploiting gold, mica and graphite deserve mention in this context. The old workings for exploiting gold, now recognised as abandoned pits, trenches, shafts, adits and underground galleries are noticed in several places of Wynad and Malappuram districts which formed a part of Wynad gold field. These were in operation during the gold boom of 1880. Main localities where these features appear are Meppadi area (Rippon mine) Chundale-Vythiri area, Tariyod area, Karinkanni area, Manantoddy area and Thavinjal area of Wynad district. In Malappuram district, it is scattered around Nilambur area (like Kappil, Mutheere, Maruda etc.)

In the Punalur area, near Kaakkapponnu Quilon district) an underground mine was in existence for exploiting the phlogopite

mica. It is understood that till 1950's the mine was in operation and had to be abandoned because of slump in market value of mica and problems of mining. At present, the mine area is completely under water.

Graphite mining by M/s. Morgan Crucible Co., during 1898 to 1912 was well known from Vellanad in Trivandrum district, but was later abandoned in view of high cost of production at depth.

Seismicity in Kerala

Eighteen earth tremors have been recorded in Kerala from the period 1341 A. D. to 1975 and majority of them are located in the coastal region. Hence, seismically, the State can be considered moderately active. All but two of the tremors were of low magnitude, generally between 3 and 4 Ron Richter's scale (RRS) and low intensity. One of the two major seismic events in the State occurred in Tamil Nadu—Kerala border near Coimbatore with the magnitude of 6 (RRS) in the year 1900, and the other major earthquake took place in the year 1341 during which the Vypin Island of Cochin came into existence.

A catalogue of seismic events in Kerala is given below:—

Sl.	Year	Epicentralarea	Magnitude
(1)	(2)	(3)	(4)
1341		Malabar coast	5.7
2	10-1-1821	Travancore	3.0
3	2-3-1823	—do—	4.3
4.	15-9-1841	—do—	3.7
5	13-11-1849	—do—	3.7
6	11-8-1856	Trivandrum	3.7
	25-8-1856	—do—	3.7
	1-9-1856	Travancore	3.7
7	13-8-1856	Malabar	3.7

	23-8-1858		3.7
8	7-2-1900	Near Coimbatore	6
9	25-2-1953	Kanjirappally and Peermed—	
	21-3-1953	Kottayam and Idukki districts	3.7
10	27-7-1953	Cochin	5
11	27-7-1959	Tellicherry—Cannanore area	4
	19-1-1960		
12	19-1-1960		
	9-2-1960		
	14-2-1960	Mangalam dam, Palghat district	
	21-2-1960		
13	24-9-1961		
	25-9-1961		
	26-9-1961	In and around Calicut	4
	27-9-1961		
	3-10-1961		
	4-10-1961		
14	Oct. 1964	Around Calicut	— —
15	9-2-1967	Northern part of Devikulam taluk of Idikki district.	
16	25-9-1968	Trivandrum	
17	27-9-1969		
	March & April 1971	Sholayar dam site	— —
18	Sept. 1975	Idukki dam area	2

Coastal Erosion :

The Kerala coast, on a broad basis forms the high energy coast, dominated by vigorous wave action. The coast is a geomorphologically active and variable zone, showing the submergent and emergent aspects, in which the geomorphological process—elements vary over a wide range of intensity, both in time and space. More than 300 km. of the coast is subjected to erosion due to constant attack by waves and tidal overflow, resulting in continuous recession, loss ofevery life and valuable

property and affecting many aspects of its economy. The coastal areas in the northern part of Alleppey district and Ernakulam district are more prone to this coastal erosion.

I) Addendum*

The entire Wynad area in the Wynad district of Kerala is in danger of recurrent landslips, a team of earth scientists has concluded after a study of the area affected by landslips in July 1984. The team has warned of serious damage to life and property because of earth-disturbances unless immediate preventive measures are initiated. The study was conducted immediately after landslips rocked the Meppadi area in the district, claiming 14 lives. The District Development Council had sought expert scientific opinion on the situation in the district with special reference to Moopainad and Edathanakkunnu in Vythiri taluk and Brahmagiri in Manantody taluk. The team has recommended that inhabitants within a five Km. radius of Mundakal be evacuated since torrential rain could cause more landslips. The immediate cause of the accident here in July was torrential rain which increased the moisture content in the already loose top-soil cover. As a result, there was capillary rise of sub-surface water along the available porespaces and conduits. It was found that the landslip was of a deep nature. The continuance of torrential rain could lead to development of cracks in higher slopes, which in turn might cause dangerous landslips. Hence evacuation of inhabitants from a five Km. radius, uphill as well as in the downslopes has been suggested.

The scientists' survey of posible landslip—prone areas around Brahmagiri Ghat hill ranges revealed a weak concave plane on its crest. There was every possibility of this weak zone developing into a slide plane in course of time, effecting a catastrophic rotational sliding of overlying rock-soil mass into the valley area. This area was devoid of human settlements and a landslip here might not cause casualties. But it was certain to cause heavy disturbances in the environment that would be difficult to set right. However, on the western side

* Based on the report of a team of earth scientists of the Department of Mining and Geology, Government of Kerala and the Geological Survey of India.

of the Brahmagiri Ghat, where a temple is located no immediate danger was likely.

A rockslide had been reported on the northern flank of the Neelimala near Chitragiri during 1961. Three persons living near the hillock were killed in the accident. Again in 1983 another accident during torrentail rain was reported.

The scientists who surveyed the area found two pedestal rocks standing out in an overhanging fashion on the northern flank of the Neelimala, about 300 metres from the Chitragiri settlement. Nearby is a lower primary school attended by about 200 students. If the precariously perched rocks crash, as is likely during heavy rain, the result would be disastrous. The team has suggested immediate evacuation of people living downslope of Neelimala and early arrangements to blast the rocks in small quantities. The blasting has to be carried out under the careful supervision of scientists.

Contour bunding of the hill for conserving the soil also has to be done in consultation with soil scientists.

The Chembra Peak Estate area, about five Km. south-west of Meppadi and comprising mostly estates is rife with scars of land creeps, some 10 metres wide. There are indications of development of a crack at the bottom of the road, cutting about half a kilometre southwest of Meppadi town. This crack could lead to a major creep affecting the settlement downslope.

The scientists have reported possibilities of many more creeps in the Chembra peak estate area which could be a threat to the colonies housing estate workers. The stability of the slopes of the region has been affected by the cutting away of lateral supports (of soil), jerks and vibrations from constant heavy traffic in the slope areas and loosening of soil due to deforestation.

In the Taryod area, about 22 Km. northwest of Vythiri, a small hillock, formed during a landslip in 1961, is posing a threat to the local people. Cracks have formed on the hill, Edathankunnu, due to infiltration of wter and rising sub-surface

water. The pressure exerted by both is bound to result in soil creep of a dangerous magnitude and could cause deaths in the northern downslope where many people live.

The area is likely to shorten the life of the proposed Banasurasagar project under the Kuttiadi augmentation scheme of the State Electricity Board, according to the scientists. This is because the area would be submerged when the project is completed but a small top-portion of the hill would remain above water be more frequent then, would affect the life of the reservoir itself through sedimentation and siltation of a high degree.

The failure of the stability of the slope and decrease in cohesive strength of the overlying material havebeen identified by the scientists as the fundamental reasons for the landslips: unimaginative human intervention in the form of heavy traffic and deforestation are other contributory factors. Heavy traffic has been cited as the main threat in the Thamarassery-Vythiri road section and on the Kuthuparamba Manantody road.

The team has suggested detailed studies to be carried out to pinpoint places prone to landslips. A slope classification of the entire area has to be taken up with the help of aerial photographs and topographic maps. Measures for retention of slopes such as construction of retention of walls, contour bunds and lateral supports have to be taken. The scientists have also recommended that while constructing roads and highways, all aspects regarding the stability of slopes should be worked out, taking into consideration the slope angle, cohesive strength of the earth material and depth of groundwter table.

The team has further called for legislation to prevent illegal and unscientific earthwork in landslip-prone areas both by private and Government enterprises. It has stressed the need for a collaboraive programme of studies effecting participation of earth scientists from the National Remote-sensing Agency, the Geological Survey of India, the Centre for Earth Science Studies, the Department of Geology, the Kerala University, the State Departments of Mining and Geology and engineers in various developmental activities. Such a study would be needed to tackle the problem of landslips effectively.

National Monument For Laterite

Most people in Kerala are familiar with the sight of '*Vettukallu*', the earthy, red stained, pitted and porous rock and also aware that the rock is extensively used as a construction material. From archaeological remains in some parts of Kerala, it is evident that the rock dressed as domes (Koda Kallu) was used in prehistoric times in burials. What most people do not know is that the rock known as '*laterite*' in geological parlance was christened in Angadipuram in the year 1800 A.D., by Dr. Francis Hamilton Buchanan from far off Scotland.

Francis Hamilton Buchanan of Scottish parentage, was born in Perthshire in Scotland in the year 1762. After obtaining a degree in medicine from the Edinburgh University in 1783, he served as a Surgeon on a man of-war and subsequently in the year 1794 joined the East India Company as a Surgeon. In the year 1800, he was deputed by Lord Wellesley, the then Governor General of India, to travel through certain parts of South India in order to compile a report on several matters including agriculture, arts, commerce etc. In the year 1802 he undertook a journey in Nepal, wheretheassiduouslycollected, studied and described a number of plants. Subsequently, Dr. Buchanan was appointed as Surgeon to the Governor General and in the year 1814, he assumed charge as Superintendent of the Botanical Gardens, Calcutta. After retiring from service in the year 1815 Dr. Buchanan returned to Scotland where he settled down and passed away in the year 1829.

Dr. Buchanan, though trained only in medicine, was a man of varied scientific interests. He was a fellow of the Royal Society and a member of the Royal Asiatic Society. During the course of his travels in Nepal, Andaman Islands and other parts of India, he was engaged in botanical researches. He studied fishes of the Brahmaputra and the Ganges rivers. It was during his travels through parts of Mysore (Karnataka State) and Malabar (Kerala State) in the year 1800, Dr. Buchanan made an observation in a rock quarry in Angadipuram which laid the cornerstone for the scientific study of a unique rock type all through the world. Keen and perspicacious as he was, the scientist observed

that the rock was soft when wet and so could be dressed into blocks and on exposure the blocks hardened and could be used as bricks for construction. The utilisation of cut blocks of th rock as bricks for construction led Buchanan to name the rock. *'Laterite'*, based on the Latin word *'Lateritis'* which means brickstone.

Nearly 18 decades have passed by since Dr. Buchanan made a significant observation in Angadipuram. Ever since. laterite occurrences in many parts of the world have been studied in detail and we have a wealth of scientific data. New names in place of laterite have been proposed, but it is to the credit of Dr. Buchanan that the name (laterite) given by him has remained unassailably and firmly entrenched in geological literature.

Laterite cannot be classified under igneous or Sedimentary of Metamorphic groups of rocks, which encompass most of the other rocks on the earth's crust. On the other hand, it is a secondary product resulting from the chemical weathering of many types of rocks. In the huge cauldeon of Nature, under a hot and humid type of climate, the rocks exposed on the surface, attacked by water, oxygen, carbon dioxide and humic acids, decay slowly; the minerals of the rocks are broken down leading to the release of iron, aluminium, silicon, calcium, magnesium, potasium sodium oxides; under appropriate drainage conditions, oxides of calcium, magnesium, potasium, sodium and silicon are leached out from the decaying rocks to varying degrees; and the remaining residue are enriched in iron, aluminium, titanium oxides to varying proportions. The residual product (Laterite) presents a pitted and porous appreance. Appropriately, laterite is called, 'the tropical disease of rocks.'

In general the mineralogical and chemical characteristics of laterites are controlled by the intensity of chemical weathering of that parent rocks and the intensity of chemical weathering is known to spiral up with increase in temperature and incidence of rains. The copious rains of the southwest monsoon and the prevalence of warm sunshine have gifted Kerala with lush green vegetation. At the same time, these climatic factors

have also been responsible for rapid chemical weathering of the original rocks on the surface, leading to the formation of laterite through the length and breadth of the State. Scientific studies indicate that it is not only the present day climate but also palaeoclimate(climate in past geological periods since several million years)which has influenced formation of laterite.

From the economic angle laterites are significant not only in India but in many other parts of the world, since mineral deposits of aluminium ore (bauxite), iron-ore, nickel ore etc., are known to be in close and intimate association with laterites. In Kerala, bauxite in association with laterite is known in the Alleppey, Quilon, Trivandrum and Cannanore districts; and iron-ores in Calicut, Kottayam, Malappuram, Quilon and Trichur districts.

It is one of the chartered functions of the Geological Survey of India to recognise unique geological features and to focus the attention of scientists and laymen alike on such features. In 1979, an International Seminar on 'Lateritisation Processes' sponspred by the UNESCO, IUGS, the Indian National Committee for International Geological Correlation Programme and the Geological Survey of India, was held in Trivandrum and a National Geological Monument for Laterite in Angadipuram, wherefrom the term laterite originated and spread throughout the world was erected.

National Laterite Monument

Francis Buchanan in the early nineteenth century
Wrote a monograph which has become legendary:
Of his traverses, across the present Kerala countryside,
Which have given food for thought and knowledge beside.

Near Angadipuram in the then working quarry site,
He found a porous rock which turned out to be a sight:
That *in situ* it could easily be cut into soft brick,
But extracted, it turned hard like Magician's trick:

He saw beneath the cover of the leached porous rock.
A weathered zone ending in solid parent rock.
The fact the latter gave rise to former came to light.
Perhaps he chronologically christened the porous product *"Laterite"*.
It diverse origin in forums is being actively debated
By geoscientists the world over and still continues unabated
But their greatest tribute to Buchanan is their sentiment
Enshrined at Angadipuram in the National Laterite Monument.

Angadipuram —Chami—
Decenber, 1979.

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* *Geological Survey of India, Southern Region, Hyderabad.*

FLORA

Geographically shut off from the rest of India by the impenetrable jungle covered Western Ghats and blessed with a heavy rainfall and warm climate, Kerala has been able to preserve a flora of great variety. "The vegetation and Flora of Travancore are of exceptional interest, first, because they are the relic and development of flora which was at one time uniform over a large part of India, secondly, because of the extraordinary variety of species occuring within a small area, and thirdly, because many of the species have been taken as types of plants with which others from all parts of the world have been compared". On this aspect, T.F. Bourdillon writes: "Owing to the geographical position of the country the flora of Travancore comprise that of Malabar and Ceylon, but it also includes many species of wide distribution, while, on the other hand, there are not a few which are peculiar to the State itself or are found in the southernmost part of the peninsula, that is, Travancore and Tinnevelly. The number of these endemic species will probably be largely augmented by new discoveries. An interesting fact which I have referred toelsewhere(Malabar Quarterly Review) is that we have many species which greatly resemble but are yet different from the species found in the Malaya Peninsula which has a very similar climate. It is probable that at one time a continuous stretch of forests extended

all over India connecting these two distant regions and that the parents of these similar species flourished somewhere in the area between them". It was this great legacy that led some historians to conjecture that the magnificent teak from the forest of Kerala was used by King Solomon in the building of the temple mentioned in the Old Testament. Kerala's teak was also used for the manufacture of ships that fought in the memorable battle of Trafalgar and brought victory to Lord Nelson. The *Palatree* (Alstonia Scholaris) has been described by Pliny in his *Natural History*. It was the wonderful medicinal properties of the herbs and roots found in Kerala that inspired the monumental treatise published at Amsterdam under the title of *Hortus Malabaricus*, an enduring monument of Dutch learning, industry and research. The work appeared between the years 1686 and 1703 in 12 volumes with 794 excellent copper plate engravings. It was compiled by Heinrich Van Rheede who came from Holland as the Dutch Governor of Cochin. Impressed by the diversity and richness of the flora of Kerala he felt like having landed in a wonderland of plants and took pains amidst his laborious official duties to make an intensive study of flora of Kerala and thereby to raise an enduring monument for himself and a rich legacy to Botanists. Frayer says: "to Mr. Van Rheede oriental history pays the tribute of eulogy in denominating him the Maecenas of Malabar. At a period when European residents in India wholly directed their attention to mercantile adventure, or attempted political aggrandisement, he could spare leisure to devote to scientific research; and his labours have provided Holland with many valuable manuscripts and other equally important curiosities, while some of his statements still challenge enquiry. *His Hortus Indicus Malabaricus*, a work in twelve volumes folio, is an evidence of his literary exertions." This work is supposed to be the first classical work on Botany in the World and naturally served as the major reference books to Carl Linnaeus, the Father of modern Botany who established the binomial nomenclature. In compiling the *Hortus Malabaricus* Van Rheede received the able assistance of Ranga Bhattan, Appu Bhattan, Vinayaka Panditan and Itty Achuthan.

The special characteristics of Kerala Flora are its charm, diversity and economic value. The unique climate and copious

rainfall from June to December aid the growth of several species of trees and shrubs peculiar to the region. The verdent hills and valley are pleasing to the eye. Rich and varied shrubs grow in the shade of the gigantic trees with creepers that cover almost every tree.

Most of the Indian botanical orders are richly represented and, in the Monsoon months the glorious vegetation beggars description. An interesting account as given in Malabar by C.A. Innes is reproduced. "Wonderful is the contrast between Malabar in the hot weather and Malabar in the monsoon. In March, when skies are brass and earth is iron, and hot land winds are blowing, the sub—baked paddy flats are bare and brown, and beneath the shade of the dusty trees the gardens are mere wastes of laterite rock and uncultivated ground. The thunder showers of April and May bring some relief to the parched soil, but Malabar is not its real self till the rains break. In the space of a single night the new grass springs up, and the calladiums push their heads above ground; and soon even the rough laterite sides of the deep ditches between the gardens are clothed with a mass of delicate ferns, and between the bare red hills the winding valleys are one unbroken stretch of the emerald green of growing paddy set of by the darken green of the trees in the overhanging gardens".

Kerala may conveniently be divided into three physical divisions: (1) the Western Ghats (2) the foot-hill zone or the midland zone and (3) the coastal plain.

Western Ghats is the most striking feature rising from the relatively narrow coastal plain. The average altitude of the Ghats is about 1,200 metres bove sea level. There are peaks reaching upto 2,691 metres. The Western Ghats reach continuously upto the southern tip of the peninsula.

Next comes the midland which consists of low hills and ridges of less than 300 metres altitude interspersed with valleys. This region has an undulating terrain with red soils in the uplands and alluvial in the valleys.

The coastal plain is a narrow stretch of low land formed by the deposition of sediments brought down by the rivers of the Western Ghats and sand deposited by the waves. The building up of the sand bars along the coast has led to the accumulation of water to form backwaters or lagoons. Vembanad lake and the Ashtamudi lake are the largest lagoons. The coastal plain is relatively even with fertile alluvial soil.

The type of vegetation in these zones is related to relief features and rainfall. Coconut and casuarina (Kattadi or choolamaram or chavok) trees abound in the sandy beaches along the coast.

The Western Ghats has deciduous and ever-green forest with economically valuable trees. The vegetation is different from that found in other parts of India. Apart from the natural forests, valuable teak plantations are also met with extensively. Lower down in the region are found rich plantations of tea, rubber, coffee, Cardamom.

Only an enumeration of economically important plants and common species are attempted here.

Angiosperms

J.D. Hooker in compiling the comprehensive '*A Sketch of the Flora of British India* between 1872 and 1897 estimated some 174 families and 17,000 species of angiosperms and 600 species of ferns and fern allies in the flora of India. About 15,900 species of flowering plants have been described in the *Flora of British India*. Several of these species are seen in Kerala of which the ten dominant families are the Leguminosae, Graminae, Rubiaceae, Euphorbiaceae, Orchidaceae, Acanthaceae, Compositae, Cyperacae, Labiatae and Urticaceae.

Leguminosae

The family Leguminosae is having three sub families viz., Papilionaceae, Caesalpiniaceae and Minosaceae. In the

sub-family Papilionaceae. the following plants are common in Kerala. *Crotalaria retusa (Kilukilukki)* An undershrub in wastelands and forests whose fibre is used for cordage and canvas. Powder or decoction of the leaves finds application in fever, indigestion, phlegm and itches. Seeds have emetic properties. *C. Juncea (Chanapayaru)* A tall herb often cultivated in compounds as a green manure. The fibre from the bark is used for fishing nets, cordage, canvas and paper making.

C. incana is a new species recorded from Kerala. *Tephrosea spp. (Kozhinjil)*, This genus contains about 15 species and are found as weeds in open places and in the foot of the hills.

These species have medicinal value and used in ayurvedic preparations. *Indigofera tinctoria (Neela amari)* A branching shrub about 1.8 metres long found in wastelands throughout the State. The plant is medicinal. *I.* benthamiana is a new species recorded from Kerala. *Desmodium spp. There are several species of this genus in Kerala, mostly found in dry places at* the foot of the hills. *Abrus pricatorius (Kunnikkuru)* A wiry climber found in bushes and hedges; a medicinal plant; also used for weighing by jewellers. *Erythrina stricta (Murukku)* A medium sized tree armed with prickles. The wood is used for fishing net floats. *Phaseolus spp. (Payar).* There are a few wild species of pea in Kerala. *P. radiatus, P. P. mungo* are some of the important cultivated species of pea as a crop. *Clitoria ternata (Sankhupushpam)* A very pretty climber with large blue flowers. Found commonly in fences and hedges in the villages. Also cultivated for medicinal purposes. Seeds, root, root bark and leaves are used in ayurvedic preparations. *Dolichos lablab (Avara, beans)*— Climber cultivated fot its edible pods. *D. biflorus (Muthira)* largely cultivated for its seeds and as a fodder crop. *Pongamia glabra (punku maram0* Moderate sized evergreen tree found in the coast forests and on river banks. Wood is hard and used for making cart wheels and similar purposes. Oil from the seeds used for burning and for medicine. It is planted as a shade tree. Sub family *Caesalpiniaceae. Poinciana pulcherrima ((Rajamalli)* An erect shrub with yellow or scarlet flowers. Usually planted in gardens. *Cassia fistula (Kanikkonna)* Moderate sized tree knownasIndian laburnum. Found in all deciduous forests. Planted in gardens

as an ornamental tree. Wood used for agricultural purposes. *Cassia tora (Thakara)* An annual weed with small yellow flowers found on way sides, waste lands and as wild undergrowth. *Sarca indica (Asokam)* A commonly found small tree with bright orange-scarlet flowers. Flowers are used in the preparation of ayurvedic medicines. *Tamarindus indica (puli)* A magnificent tree attaining a height of about 37 metres not indigenous in Kerala, but seen wild. Often planted along the roadside as an avenue tree. The heart wood is dark brown in colour and close grained. Wood is used for oil presses, sugar mills and also used by local butchers. According to Beddome it burns green and is esteemed as excellent for gun-powder charcoal. The valuable produce is its fruits, the pulp of which is astringent and asperient. It is much used by all classes of people in South India in condiment and for curing fish. Large quantities are exported to other countries where it is used for pharmaceutical purposes. Seeds and leaves are used medicinally. The seeds are also used as a cattle feed. *Sub Family Mimosaceae Adenanthera Pavomina (Manchadi)* A handsome deciduous tree commonly cultivated in gardens and avenues. Bright red biconvox seeds are used as jeweller's weights. *Mimosa pudica (Thottavadi)* This is a diffuse thorny troublesome shrub under with very sensitive leaves found in all humid location. *Pithacolobium dulce (Korukkapuli)* A fast growing thorny tree. When planted close and kept neatly pruned, it makes an elegant and impassable hedge.

ROSACEAE

Rosa leschenaultiana is the rose plant commonly cultivated in gardens. There are so many varieties now under cultivation in Kerala.

DROSERACEAE

Drosera burmanni is an erect insectivorous plant found in moist damp places in the hills and low land.

RHIZOPHORACEAE

Rhizophora mucrunata (Pikantal) Glabrous evergreen mangrove tree found in the tidal forests of the coasts. Bark is of medicinal value and used for diabetes. *Carallia integerrima*

(Vallavam) A pretty evergreen tree found in the low land as well as in the forests upto a height of 1500 metres. Also planted in gardens as an ornamental tree.

COMBRETACEAE

Terminalia catappa (Thalli maram) A large deciduous tree cultivated in the gardens and avenues. *T. Belerica* (Thanni) Large deciduous tree. Fruits used for dyeing cloths and leather tanning and in indigenous medicines. *T. Chebula (Kadukka)* Large tree found in the slopes of the western ghats, upto a height of 1500 metres. It yields valuable tanning and dyeing material. *Quisqualis indica.* Large climbing shrub with conspicuous long-tubed flower which change colour from white to orange and red. Cultivated as a flowering plant in gardens. It is commonly known as Rangoon creeper.

MYRTACEAE

Psidium guajava (Pera) A small tree, cultivated extensively for its edible fruits. *Eugenia jambos* (Jamba) Small tree with edible fruit and cultivated extensively. *Eucalyptus globulus.* A lofty tree cultivated in the forest for paper pulp and Eucalyptus oil.

LECYTHIDACEAE

Barringtonia racemosa (Samudrakka) A medium-sized tree found near backwaters. Often planted as an ornamental tree. *Carreya arberea* (Pezhu) Planted as a support tree for pepper which is also used for making agricultural implements.

MELASTOMACEAE

Melastoma malabathricum (Kadali, Kalampotti). A shrub with large red purple flowers found in wet places on the bank of streams. *Memecylon edule* (Kayampoo, Kashavu). Large shrub with blue flowers found in the plains and in the forests.

LYTHRACEAE

Lagerstroemia lanceolata (Venthekku). Large tree, the timber of which is used extensively for building purposes. *L. Speciosa*

(Poomaruthu) Large deciduous tree often planted in gardens for its beautiful pink and rose flowers. All parts of the plant, especially mature leaves and ripe fruits contain hypoglycemic properties having activity equivalent to 6—7.7 units of insulin. *Lawsonia inermis* (Mylanchi). Deciduous shrubs with white flowers found in all plains and often cultivated as a hedge plant. Yields a material for dye. The plant is of great medicinal value. *ONAGRACEAE (Ludwigia parviflora)* An erect herb upto 50 cm. high, often found in the rice fields, and at wet places.

TERNERACEAE

Ternera ulmifolia (Cheravathali). A common weed with yellow flowers found in waste lands.

PASSIFLORACEAE

Passiflora leschenauttii (Poochapazham). A climbing shrub found in the low lands and bushes and also in the hills upto 2,000 metres.

CARICACEAE

Carica papaya (Papa, oma). This weak stemmed tree is cultivated for its edible fruits. Contains an alkaloid called papa in which is highly medicinal.

CUCURBITACEAE

Memordica charantia (paval). A slender twining annual creeper often cultivated as a vegetable. It possesses medicinal properties also. *Cucumis melo* (Thanni mathan). Water melon is largely cultivated in sandy soil during summer. *Cucumis sativus* (Vellarikka) cultivated as a vegetable.

CACTACEAE

Centella asiatica (kudangal). A common climber found in the edges of rice fields and in hills in wet places. Highly medicinal and used in varius ayurvedic preparations. *Hydrocotyl javanica*—Prostrate herb found in moist places in the hills. Used as a substitute for *centella asiatica*.

ARALIACEAE

Aralia malabarica. Large shrub with scattered prickles on

the stems and leaves. Found in evergreen forests upto 1000 metres. *Polyscias fruticosa* is an erect shrub with much cut leaves, frequently grown in gardens as an ornamental foliage plant.

CORNACEAE

Mastixia pentandra (Neerkurunthu). Large tree found in evergreen forests and on river banks.

ALANGIACEAE

Alangium lamarckii (Angolam). Leaf bark and leaves are highly medicinal. Used in the treatment of fever, skin disseases, and in rheumatic pains, found in the forests.

CAPRIFOLIACEAE

Viburnum acuminatum. A small evergreen tree with white flowers, found in evergreen forests upto 2000 metres.

RANUNCULACEAE

Clematis bourdillonil. A climbing shrub found in Ponmudi.

DILLENIACEAE

Acrotrema arnottianum. A forest herb growing upto an elevation of 1000 metres. *Dillenia indica* (Syalita) A beautiful evergreen tree often cultivated in gardens and near temples. Fruit of medicinal value used in the treatment of fever and cough. Bark and leaves contain tannin.

ANONACEAE

Uvaria narum (Narampanal). A struggling shrub found in thickets in the low lands and forests, roots having medicinal properties. *Artabotrys odoratissimus* (Manoranjini). Struggling shrub cultivated in gardens. *Polyanthea longifolia* (Aranamaram). An evergreen tree often cultivated in gardens. *P. longifolia var pendula* is commonly known as drooping asokam, considered as an interesting ornamental foliage tree with peculiar drooping branches and leaves. *P. Korinti* (Korintl). A spreading shrub found in the forests. *Phaeanthus malabaricus A small tree* found in Wynad about 700 metres above the sea level. *Anona squamosa* (Aatha, Aathy) custard apple, a shrub often cultivated

for its edible fruits. *Anina reticulata* (Aatba, Aathy) cultivated for its edible fruits.

MENISPERMACEAE

Tinospora cordifolia (Amruthu) A climbing succulent shrub with serial roots found in low lands, and forests. Stem and starch from the roots used in indigenous medicines.

Cessampelos pareira (Kattuvalli). A tomentosa climber very common in low land. Root is used in the treatment for respiratory, urinary disorders. Leaves used for external application for skin diseases.

NYMPHAEACEAE

Nymphaea stellata (Ambal). Very common in tanks and backwaters. *Nelumbium speciosam* (Thamara) found in tanks and ponds and backwaters.

PAPAVARACEAE

Argemone mexicana (Brahmadanti, Ponnummatta). An exotic prickly annual found on the side of road. Yellow juice of the plant is used as a remedy for dropsy, jaundice and skin diseases. Root and seeds have medicinal value.

CAPPARIDACEAE

Gynaudropsis pentaphylla (Kattukaduku). An annual weed, found commonly in waste lands.

Crataeva religiosa (Nirmathalom). Medium sized tree often found along river banks. Leaves having medical value are also used for religious ceremonies. *Cleome viscosa* (Nai kaduku). A common weed with yellow flowers found in fields and waste lands.

VIOLACEAE

Viola serpens. Found in the hilly places. *Hybanthus enneaspermus.* A common weed in grass-lands. Leaves, roots, and fruits are medicinal and used in indigenous medicinal preparations.

BIXACEAE

Hydnocerpus laurifolia (Maravatti). A large ever-green

tree. The oil extracted from the seeds is used in the treatment of leprosy and skin diseases and as fish poison. *Flacourtia sepiaria* (Cherumullikka chedi). A small thorny shrub often found in waste lands. Infusion of leaves and roots used as antidote for snake-bite. Bark is used in treatment of rheumatism.

POLYGALACEAE

Polygala chinensis. An annual herb very common at Veli in Trivandrum. Root is given in cases of fever and dizziness.

CARYOPHYLLACEAE

Drymaria cordata. A diffuse glabrous shrub found in shady places at Ponmudi hills, Trivandrum district. Juice of the plant is used medicinally. *Polycarpea corymbosa*. A weed often found in dry sandy soils.

PORTULACAEAU

Portulaca oleracea (Koricheera). A prostrate succulent herb found in all dry places. Juice of stem is used for pickly burn.

GETTFERAE

Garcenia indica (Kodapuli, Penampuli). An ever-green tree common in low lands. Fruit edible. Bind of the fruit used in the preparation of curries, as a condiment. Oil is used in the treatment of skin diseases. *Calophyllum inophyllum* (Punna) A tree found commonly. Leaves used as fish poison. Bark, gum and juice are also used in the preparation of indigenous medicines.

DIPTEROCARPACEAE

Dipterocarpus indicus (Kalpayin). A lofty tree found in ever-green forests upto 100 metres. *Vateria indica* (Payin) commonly found in ever-green forests upto 500 metres and occasionally along rivers in tropical moist deciduous forests. Oil from fruits used as local application in chronic rheumatism.

MALVACEAE

Sida cordifolia (Kurunthotti). A weed of wild growth. Used extensively in Ayurvedic system of medicine. *Sida rhombifolia* (Anakkurunthotti). A weed of wild growth. Used extensively

in Ayurvedic preparations. *Abutilon indicum* (Ooram). An erect woody herb found in wastelands and the side of roads. Leaves, bark infusion of roots and seeds are used in medicines. *Urena lobata* (udiram). A common weed on waste lands. Root used in the treatment of rheumatism. *Hibiscus tiliaceus* (Neerparuthi). A branched tree with soft wood found in the low land. Root considered medicinal. *H. rosasinonsis* (chemparathy). Many varieties on the basis of colour and nature of flowers are cultivated in gardens for the beautiful flowers. *H. esculantus* (Venda). Fruits used as vegetable and hence cultivated.

Salmalia malabarica (Elavu). A conspicuous tree found in the forests and also grown in low-lands. This is also called silk cotton tree. The cotton from seeds for making matresses. Wood is soft and used for catamarams and match sticks and boxes.

STERCULIACEAE

Heritiera littoralis. Tree found in the forests grows upto an elevation of about 1000 metres above sea level. *Sterculia urens* (Thondi). Tree found in low country and in forests. The gum obtained from the tree is used in the treatment of throat infectio Leaves and tender branches yield a mucilagenous extract when soaked in water used in pleuro-pneumonia in cattle. *S. villosa* (Vakka). A large deciduous tree found in the forests of Kerala. Bark gives a strong coarse fibre used as ropes to tie elephants. *Helicteres isora* (valampiri). A large shrub with twisted fruit found in all forest undergrowths. Fruit is useful in the griping of bowels and flatulence of children. Bark and juice of root are also considered as medicine.

TILIACEAE

Grewia microcos (Kottakka) : An erect shrub common in thickets and in waste lands.

LINACEAE

Hhgonia mystax (Mothirakkanni) ; A climbing shrub

commonly found in forests.

OXALIDACEAE

Oxalis corniculata (Puliyarela) ; A diffuse creeping weed found in wet soil. The plant is used as a cure for scurvy.

GERANIACEAE

Biophytum sensitivum (Mukkutti) : A medicinal herb found throughout Kerala. Leaves, powdered seeds, decoration of roots and ash used in the preparation of indigenous medicines. *Impatiens balsamina* (Kasithumba). A herb found in moist places and is used for treatment of rhumatic pains.

I. chinensis is another species of Impatiens found in this State.

RUTACEAE

Evodea lunu-ankenda (Kanalei) : A small tree found in Western Ghats and in thickets in the low lands. Decoction of the root or root-bark of this plant boiled in oil has cosmetic value. Acronychia peduculata (Muttanari). A small ever-green tree found in low lands in thickets. Plant is considered as fish poison, bark of the plant used as application to sores and ulcers.

Glycosmis pentaphylla (Panal, Panchi) : An ubiquitous shrub found as undergrowths of the forests and other places. *Murraya Koenigii* (karivepu). A small tree with aromatic leaves cultivated in most houses. It has both culinary and medicinal value.

Citrus spp. (Narakam) : This genus includes both wild and cultivated species and varieties.

MELIACEAE

Melia azadirach (Malavepu) : A small tree often cultivated for its medicinal properties. *Azadirachta indica* (vepu) Deciduous tree found in forests. Wood resembles that of Mahogany.

Valued as a medicinal plant.

RHAMNACEAE

Zizyphus jujuba (Cherumali, Ilantha) : A small tree with bramches. Commonly seen in deciduous forests. The Root, leaves, fruit and bark possess medicinal value.

VITACEAE

Cissus quadrangularis (Changalmparanta) : A climbing shrub with quadrangular stem found in dry waste lands. Leaves, young shoots and juice of stem are used in the preparations of medicine.

SAPINDACEAE

Cardiospermum halicacabum (Uzhinjia). A climbing herb found inside the compounds of village houses. The plant has got medicinal properties. *Sapindus laurifolius.* A stout shady tree found in open forests at low elevations. The fruit is used as a substitute for soap.

RUBIACEAE

Nuuclea missionis (Aattu vanchi) An ever-green tree growing at about 500 metres above sea level. Commonly seen in river beds of Kerala forests. Powdered bark of this tree is considered as a remedy for leprosy, ulcers, rheumatism and constipation.

Anthocephalus indicus (Kadambu) : An ever-green tree on river sides. Also found near Western Ghats. Bark and decoction of leaves considered as medicinal. *Mitragyna parvifolia* (nir Kadambu) A large deciduous tree. Light pinkish brown wood is used for furniture, and agricultural implements. *M. tubulosa* (malam Thumba) A small tree mostly found in High Ranges. Wood is pinkish brown. *Wendlandia angustifolia.* A small tree seen at Peermedu in Idikki District. *W. notoniana* (Vellai thalachedi) wood is used for building purposes. *Hymenodyctyion excelsum* (Itthilan) known as bastard cedar. A tree of the Deciduous forests. Grows at about 500 metres above sea level. Wood is popularly known as Vella Kadambu. It is used for tea chests, grain measures, toys, black boards, packing cases etc. Leaves used in dying. Bark used as a febrifuge and used in tanning. *Dentella repens* A straggling weed in moist places especially in rice fields. *Neurocalyx wightii* A small tree in the moist evergreen forests. The tree grows at

about 1000 metres above sea level.*Oldenlandia corymbosa* (Nonganan thumba) A common weed. Decoction of the plant given in remittent fever with gastric irritation and nervous depression. Also given in jaundice and diseases of liver. Juice applied in burning of the palms of hands and soles of feet from fever. *O. diffusa.* A common weed found throughout the state. Decoction of plant used in biliousness. *O. Ramarowi* An undershrub found at Ponmudi about 1000 metres above sea level. *O. Wyanadensis.* A weed found at Wynad at about 2000 metres above sea level.*O. Lassertiana.* A stout erect shrub with white flowers and scarious tabular stipules. Found at Anamalai hills. *O. beddomi.* Found in open grassy places at about 2000 metres above sea level. *O. Verticillaric* Found growing in Western Ghats about 2000 metres above sea level. *O. Crystallina.* A prostrate annual herb found in western coast. *O. Umbellate.* A stiff biennial or perennial herb found in the coastal sands, having attractive lilac flowers. Bark of the root gives a valuable red dye. Often cultivated. Root used for treatment of snake-bite. *O. biflora* (Parpadaka pullu) A diffuse annual weed with white flowers. Plant used in remittent fever, gastric irritation and nervous depression. *Anotis decipiers.* Often found in the hills. A slender perennial, rooting at the lower nodes, the upper stem erect. *A. rheedii.* A slender annual herb with filiferm pedicells and quadrangular stems found in west coast and western ghats. *A. quadrilocularis.* Often seen in rock crevices at hills about 2000 metres above sea level. *Ophiorrhiza mengos* (Avilpori) A herbaceous under shrub with white flowers seen in evergreen forests at low elevations. Root believed to be a remedy for bites of mad dogs and snakes. Decoction of root, leaves and bark used medicinally. It is also used as an antidote to insect poison, in ulcers, leprosy and worms in the intestine. *O. Harrisiana.* A low soft herbaceous plant with white of pinkish flowers. Seen in forests upto 1500 metres above sea level, as an undergrowth. *O. Barberi.* An erect slender undershrub with lax glabous cymes of pretty flowers. Seen in hills above 1000 metres above sea level. *O. Hirstutula.* forest undergrowth from 1000--2500 metres above sea level. *O. Eriantha.* An undershrub seen in high ranges. *O. Pectinata.* An undershrub found at Quilon. *Mussaende tomentosa.* A stragglish shrub with white flowers

turning yellowish. Found at western ghats at about 1000 metres above sea level. *M. Glabrata*. A climbing shrub nearly glabrous with orange flowers and very lax inflorescence, the long calyx lobes conspicuous. Root given with cow's urine in white leprosy. White leaves given in milk in jaundice. Flowers given in Asthma, intermittent fevers dropsy. Externally applied as detergent to ulcers. Root rubbed in with water applied to burning eyes and juice of fruit and leaves applied in cases of dimness of eyes. Powder of leaves and bark taken in honey to purify blood. ***Acranthoera grandiflora***. A pretty herbaceous plant with erect stem apparently about 15 cm. long, and pale blue flowers. Found in moist forests upto 1500 metres above sea level. ***A. annamallica***. Found in Western Ghats at about 1000 metres above sea level, on banks of rivers in moist forests. A low herbaceous plant with a very short stem. Flowers deep blue. Commonly found in Anamalai. *Mycetia acuminata*. A forest undergrowth in western ghats at about 1000 metres above sea level. A soft small shrub with large membranous leaves and orange yellow berries. *Urophyllum Zeylanicum*. A shrub with narrow elliptic lanceolate, acuminate leaves and orange yellow berries. Usually found in Anamalai *Tarenna asiatic* (Pavatti) Plants having large leaves with impressed nerves. Flower large and conspicuous with persistant calyxlobes. Found in Anamalai at about 1500 metres above sea level. Wood of this tree used for making fishing boats. ***Randia uliginosa*** (Punnumkara). A small deciduous tree with white fragrant flowers. Found in deciduous forests upto 1000 metres above sea level. Leaf is considered as a vegetable. Unripe fruit astringent and when roasted is used as a remedy in diarrhoea and dysentery. Boiled root with ghee is given in dysentery.

Randia dumetorum (Kara). Found in dry forests on the slope with white flowers wood used as fuel and for making agricultural implements. Unripe fruit is used for poisoning fish. Root yields an yellow dye. Bark a sedative. Powdered pulp is useful in treatment of dysentery. Fruit used as a medicine for piles. Unripe fruit powdered and used to wash clothes instead of soap. Aqueous extract of root bark activity insecticidal. ***Randia malabarica***. Found in dry evergreen forests. An erect throny shrub with white scented flowers. Fruit is red when ripe and seeds are of orange colour. *Gardenia gummifera*.

Found in deciduous forests. A small shrub with rough twisted branches. The resin obtained from the tree used in treatment of animals. It is used internally in hystic flatulant dyspepsia and nervous disorders. It is a good anthelmintic. *Gardenia jasminoides (Karinga).* Cultivated in gardens for its attractive white fragrant flowers. *Trycalysia sphaerocarpa.* Found in western ghats. A small tree with smooth leaves and very small flowers. *Knoxia corymbosa.* Found at Wynad. An erect undershrub with white or pinkish flowers with long slender spikes. *Guettarda speciosa* (palneer chempakam). A garden tree with white fragrant flowers. *Cantium dicoccum* (Irumparathan, Kattara). Found in dry evergreen and open forests often on river banks. A small evergreen tree. Bark powdered and applied to fractures. Wood used in making combs. Bark used in fever. Leaves contain hydrocyaric acid. *C. Pergracile* (Aana Kumbil). A graceful, tall straight stemmed tree with greenish ,yellow flowers. Seen in evergreen forests. Young shoots are utilised for making walking sticks. *Canthium parviflorum. Found in dry planes and scrub jungle. A thorny shrub with small white flowers. Decoction of leaves and roots* used in the preparation of indigenous medicines. Fruits and leaves are edible. Stem yields a fibre. *Octotropis travancorica.* Found in Wynad and in most of the hills of Kerala. A shrub or a small tree reaching 4—5 metres in height, with white flowers and a single seeded berry. *Ixora Polyantha.* A large handsome shrub with white flowers and yellowish red fruit. *I. lanceolaria.* A pretty shrub with white flowers found in the west coast. *I. notoriana* (Iramburuppi) Found in the forests of Kerala about 1000—2000 metres above sea level. A small tree with red flowers. Wood is hard and close-grained. *I. Lawsoni* A small tree with very congested villous inflorescence. Found in Kerala forest upto a height of 1000 metres above sea-level. *I. Elongata.* Found in western ghats, Wynad, and Attappadi hills about 1000 metres above sea level. A shrub with pink flowers and long-peduncled inflorescence. Fruits large, become dark when ripe. *I. Cunecifolia* A shrub with pubescent calyx and white or pink flowers. Infusion of leaves given in fever. *Ixora coccinia* (Thetti, thechi). A shrub with brilliant scarlet flowers. Yellow and pink, varieties are also seen. Fruit edible. Roots and flowers are used for dysentery, fever, gonorrhoea and

externally applied to head-ache and boils. It is considered to be sacred by Hindus and used for pooja. *I. Parviflora.* Found in deciduous forests and evergreen forests in almost all districts of Kerala. It is popularly known as torch tree. A small evergreen tree with white flowers. Both root and fruit used in treatment of female urinary ailments when the urine is highly coloured. Fruit edible. Wood used for both engraving and for fuel. Pavetta Indica(Pavetta). Grows as an undergrowth of deciduous forests upto 1000 metres above sea level. A small tree or large shrub with pretty white flowers and very variable leaves. Leaves boiled in water used as a fermentation for haemorrhoid poisons and for piles. Root has diuretic properties, used for visceral obstructions and has a purgative action. Fruit and root powdered and mixed with honey used for treatment of rheumatic fever dysentery and diarrhoea and hernia. *P. Hispidular* (Vella pavetta). Found in evergreen forests upto about 1000 metres above sea level. A narrow leaved shrub with yellowish long-tubed flowers having prominent long styles. *P. Zeylanica.* Found in western ghats, Wynad, Attappadi hills and in other hil

Found in western ghats, Wynad, Attappadi hills and in other hill areas about 1000 metres above sea level. A large shrub with oblong leaves and long-tubed flowers. *Coffee arabica.* The coffee plant. Cultivated in the hills. A large shrub with white flowers. *C. Trancurensis.* Found in forest undergrowths upto 1000 metres above sea level. Flowers white and sweet scented. A slender undershrub with thin leaves. *Psychotrea johnsomin* Found in the hills of Cochin and Malabar about 1500 metres above sea level. A glaborous shrub. *P. dalzelii.* Found in *the hills about 2500 metres above sea level in shola forests. A large shrub, the pits in the nerve axils of the leaves very* conspicuous. Flowers greenish. *P. Anamallayana.* Found in hills upto 1500 metres above sea level, generally on the river banks. A small tree with white flowers and purple fruit. *Chasalia curviflora* (Akkavamkolli, Vellakurinji). Common in evergreen forests upto 1500 metres above sea level. A small shrub with membraneous leaves, flowers pinkish white. Fruit purple black. Decoction of root used in rheumatism, pneumonia, etc., ear and eye diseases and sore throat. Roots and leaves used in external application for wounds ulcers and head ache. *Morinda*

tinctorea (Manjanathi). Found in most of the places of the State, particularly in coastal forests. A small tree with white flowers and large fleshy fruit. The roots give a red dye. Charred leaves made into decoction with mustard form a domestic remedy for inflantile diarrhoea. Leaves and root bark boiled in oil applied to itches. *M. Umbellata*. A diffuse climbing shrub in evergreen forests with rather variable usually membranous leaves and flowers in many-branched terminal umbels. Decoction and powder of bark given in fever, ulcers and eruptions. Decoction of leaves cures indigestion. *Borreria stricta*. A common forest undergrowth usually seen upto 1500 metres above sea level. *B. Ocymoides* (Tharakkera). A branching herb, common in central and southern Kerala. *B. Hispida* (Madanagandhi, Tharavu Kudal churukki). Very common in all dry lands in Kerala. Also seen at hills about 1000 metres above sea level. A procumbent herb with long branches, long-tubed flowers and hard fruits. Seeds cooling and given in dysentery. Roots resemble sarasaparilla (Narunandi) and is employed for similar purposes as an alternative, and as a blood purifier. Leaves eaten as vegetables. Decoction or powder of roots and leaves used as a remedy in rheumatism, indigestion and to cure haemorroids. The vapour is inhaled to prevent tooth decay. *Rubia cordiofolia* (Manjishta). Found upto 2500 metres above sea level. Common in Anamudi. A climbing herb with long peteoled leaves. Flowers small and green. Fruits purple in colour. Root used in the treatment of paralysis, jaundice, obstruction in the urinary tract and in amenorrhoea. Fruit useful in hepatic obstructions. Parts of root with honey is applied to remove freckles and other discolouration of the skin. An external application useful in inflammation, ulcers, and skin diseases. Root yields a red dye. Used as a colouring ingredient of medicinal oil.

Compositae

Centrantherum anthelminticum (Kattu Jeerakam). Often seen on road side. A large erect annual with purple flowers. Seeds are used both as an anthelmintic and as pesticide. Seeds are also used in skin diseases, and in scorpion sting. *C. reticulatum*. Found growing in regions 2000 metres above sea

level. A handsome plant attaining a height of a metre *C. phillolaenum*. Common in northern Kerala at levels upto 1000 metres. A very variable annual herb. *Veronia monozis*

%1 Peermedu and Cardamom hills..V.*Travancortic* (Thembu). Found in evergreen forests in the hills of Kerala at about 1000 metres above sea level. A small tree reaching about 10 metres height. *V. Anthelmintic* (Karinjeerakom) An annual. Seeds bitter, pungent, astringent, and used as a remedy in fever and cattle diseases. Seeds used to expel round worms and in medicine for leucoderma and other skin diseases, in snake bites, coughs and powder mixed with lime juice used to expel pediculi from the hair. Seeds yield an oil. *Elephantopus scabur* (Anchuvadi). A herb seen as a forest undergrowth. Found almost everywhere. Plant is astringent, febrifuge and expels bile phlegm and cure urethral discharges. Decoction of root and leaves with cumin and buttermilk given in diarrhoea and dysentery. Leaves squeezed and boiled with rice given orally inflammation of the body or abdominal pain. Powder or decoction of root given in honeyfor malaria, rheumatic fever, ulcers and dysentery. Root powdered with pepper applied in toothache. Leaves crushed and boiled in coconut oil applied to ulcers and eczema. *Adenostemma lavenia*. Commonly known as spanish needle. An annual weed in the swamps in Kerala. Leaves and fresh juice used medicinally. *Ageratum conyzoides* (Venal Pacha). An annual weed. This plant has strong smell. Juice is a good remedy for prolapses. Oil blended with the juice applied in rheumatism. Leaves applied to cuts and sores. *Centepeda orbicularia*. Usually seen in wet places. A diffuse often prostrate small herb having obovate leaves with few teeth. *Cyathodine lyrata*. Seen at low levels in moist places, rice fields, banks of streams and in wet places. A very pretty sweet-scented herb with rose-purple flowers and very much cut leaves. *Grangea maderaspatana* (Nelumpala). A common weed usually growing prostrate on the ground or sandy land and in waste places. Flowers yellow. Leaves considered as a valuable stomachic medicine having antispasmodic properties, used in delayed menses and hysteria. Juice of leaves employed as soothener in ear injection. Leaves powdered and used as an

antiseptic application to ulcers. The plant is used in preparing antiseptic and anodyne fomentations. *Myriactus wighti.* An annual weed with ovate leaves and white flowers. Found at places about 2500 metres above sea level. *Conyza viscidula.* A tall much branched viscid herb found at Wynad. *C. Stricta.* An erect plant with very small yellowish flowers. Usually found in the hills of Kerala. *Blumea Amplectens. A small herb* with yellow flowers. Found near sea coast and in Aryankavu. *B. Wightiana.* A strong-smelling erect herb found in hills upto a height of 1500 metres above sealevel. *B. Lacera.* A strong-smelling weed seen throughout low-elevations. Very variable leaves and yellow flowers. An astringent eye-wash is made from the leaves. An oil is distilled from the plant. Juice of leaves used as an anthelmintic. Fresh root held in the mouth relieves dryness. The plant is used as a febrifuge and to stop bleeding. Mixed with black pepper, given in Cholera. *B. Hieracifolia.* A herb with one close terminal cluster of heads and small leaves. Flowers yellow. Found at about 2000 metres above sea level, wet places and at the banks of streams. *B. Virens.* A Tall slender glabrous herb with yellow flowers, found in hills upto 1500 metres above sea level. *B. malabarica.* A tall erect herb with narrow leaves. *B. spectabilis.* A tall shrub with yellow flowers, found in all districts. *Laggera alata.* A stout rough leafy herb with conspicuously winged stems and drooping flowers. Used in Madagascar as a disinfectant. *L. aurita.* A slender viscidly pubescent herb. The plant has an odour of turpentine. *Pluchea tomentosa.* A large shrub with broadly obovate, dentate and auricled leaves. *Sphacranthus amaranthoides.* Found in rice fields and near the sea coast. An erect stout-stemmed herb with the odour of mint. Flowers red. *S. africanus.* A slender glabrous fragrant herb with white or purple flowers, found in swamps, particularly in the northern districts of Kerala. *S. indicus* (Adakkamanian). Common in the paddy fields. An aromatic herb with glandular hairy stem and branches and pink or purple flowers. Seeds and root are anthelmintic. An oil having the odour of lavender oil is distilled from the fresh herbs. The plant is useful in bilious affections, and for the dispersion of various kinds of tumours. Confection of young plants with butter, flour and sugar taken as a tonic and as a hair restorative. Oil obtained by boiling the root in gingelly

oil is tken as a powerful aphrodisiac. Decoction of root with cummin seed powder given in bowel ailments and with sugar for cough and chest pains. Bark of root is considered as a remedy for piles. Flowers used in skin diseases. The whole plant powdered in ghee is a remedy in hernia, enlarged spleen, constipation, poison and stone in the bladder. *Anaphalis beddomei*. A loose undershrub found in hills at a height of about 2500 metres above sea level. The main stem decumbent. Branches erect and leafy. *A. travancorica*. Found at Devikulam about 2500 metres above sea level. A large herb, sometimes shrubby at base with large flower heads. *A. elliptica*. A soft, white wooly herb. Bracts white or pink. *A. notoniana*. A pretty herb with yellow or pink bracts, found growing at about 2500 metres above sea level. *A. meeboldii*. A much tufted woody plant about 30 cm. tall with thick root stock and many branches with flower heads. *Carpesium cernum*. Found in forests of Kerala, about 2000 metres above sea level. A slender herb with small leaves. Used as a medicinal plant in China. *Vicoa indica*. Found as an undergrowth in the decidous forests. An erect herb with bright yellow flowers. *Xanthium strumarium*. Found on road sides and waste lands. An annual plant with triangular, cordate, often three-lobed irregularly toothed leaves. Fruits are with strong hooks *Moonia heterophylla*. Found in damp shady places.A perennial undershrub with golden yellow flowers in pinnate, serrate leaves. *Acanthospermum hispidum* (oorpan). Found on waste lands. Plant is hairy. *Seigesbeckia orientalis*. Found mostly in waste lands. A large annual herb with yellow flowers and large triangular deeply cut leaves. Flower heads glandular and very sticky. Juice of the plant used as a dressing for wounds and decoction of leaves and young shoots used as a lotion for ulcers and parasitic skin diseases. A tincture made out of this plant is used as a remedy in syphilitic affections and externally with glycerine in ring worms. The fresh plant has antiseptic properties and is applied to sores. *Eclipta alba* (Kaithonni). A weed growing almost everywhere in Kerala, particularly in moist places. Plant is used externally and internally to turn the hair black and as a dyeing agent in tatooing. Fresh plant with gingelly oil applied externally in Elephantiasis. Juice of root is an emetic purgative. It is also used in various veterinary medicines Leaves used as

vegetable. Juice of leaves boiled in oil used as antidote to poison and in anaemia, indigestion and worms. Leaf is a good remedy for the sting of scorpions. Juice of plant with powdered pepper given as anthelmintic, in asthma, rheumatism, cough, swelling, leprosy, and eye diseases. *Blainvillea rhomboides*. Found in rice-fields and waste places. A rigid scabrous herb with yellowish or white flowers. *Wodelia calendulaceae*. A procumbent perennial herb found in marshy places. Stems rooting at the nodes. Leaves useful in cough, cephalalgia and in skin diseases. Decoction of plant is also used in the preparation of various indifenous medicines. *W. urticaefolia*. An erect herb. Sometimes it grows as an undershrub. Found in most of the moist forests. *W. biflora*. A climbing shrub, usually found near the sea shore. *Spilanthes acmella* (Kuppa manjal). A common weed in almost all plains of Kerala. Yellow conical flower heads which are used for inflammation of the periosterum of the jaws and used as fish poison. The plants and flower heads are very acrid and has a hot burning taste, causing profuse salivation. It is a powerful stimulant, used in head ache, tooth ache and paralysis of the tongue. *Guizotia abyssynica* (Katellu). Commonly called foolish oil plant. A herb with conspicuous yellow flowers. Plant often cultivated. Oil from the seeds used in cooking and as a substitute for ghee, and for painting and cleaning machinery. Oil-cake is a good manure but unfit for feeding cattle.*Synedrella modiflora*(Mudiyanam-pacha). An erect dichotomous herb with ovate lanceolata leaves. Boiled leves used medicinally in Ghana Gold. *Bidens pilosa*. An erect herb with dissected leaves. Flowers with white rays and yellow disc. Infusion of the plant is a cough remedy in Malaya. In Brazil, leaves of this plant is applied to treat septic ulcers and swollen glands. In Ghana, the juice of the leaves is squeezed into the eyes or the ears to cure eye or ear complaints. Cosmos sulphureus. A mexican plant closely allied to Bidens but with larger pink flowers. Often cultivated in gardens, but seen run wild. *Tridax procumbens* (Thelukuthy). Introduced from America and is found in all dry places. A straggling herb with several cut leaves, yellow flowers and fruits with feathery pappus. The juice of the leaves is an antidote for scorpion sting. *Cotula australis*. Found in hills of Kerala at about 2000 metres above sea level. Probably a plant

introduced from Australia. A small erect herb with pinnatified leaves. *Artemezia parvifolia*. A perennial herb found in hills about 1000 metres above sea level. *A vulgarris* (Tiru nitripacha). Common in villages and waste lands. It is also seen in hills about 2000 metres above sea level. A tall aromatic shrub reaching 5-6 ft. high, often grevarious. This is used as a febrifuge, as a substitute for cinchona in fevers and has tonic properties. Ash is a good manure. The plant has antispasmodic properties. Infusion given in obstructed menses and in hysteria. *Chrysanthemum coronarium* (Jamanthy). Cultivated in gardens as an ornamental flowering plant. This plant mixed with black pepper is a remedy in gonorrhoea. Flowers are of various colours. *Emelia sonchifolia* (Muyalcheviyan). Found in the plains and upto 1500 metres above sea level. A soft straggling herb with purple flowers. Decoction used as a febrifuge and juice given with sugar in bowel complaints. Leaves eaten raw in salads in China. Juice of leaves help in preventing night-blindness and inflammation of the eyes. It is as cooling as rose-water. *Nonia grandiflora*. Found growing at a height of 1500 metres above sea level. A fleshy shrub reaching about 2 metres in height, with pale yellow flowers. In dry hot places, the flower heads are few. In damp locations they are often in rather large corymbs. The plant is considered as a remedy in hydrophobia. Fresh stems infused in water for a night and the viscid juice extracted, mixed with water is administrated for 3 successive days. *N. Walkeri* Found in shola forests about 2500 metres above sea level. A tall shrub reaching 2 metres in height, with large yellowish inflorescence. *Crysium argyracanthum*. Often seen in open plains and at a height of 1500 metres above sea level. A tall thistle with very spinous leaves. *Tricholepsia amplexicanlis*. A tall erect leafy herb reaching nearly 2 metres height with purple flowers. *Amberboa divaricata*. Found in dry stony ground and upto 700 metres above sea level. Often seen in sandy river banks. A stiff straggling herb with pale purple flowers and usually oblong, undulately lobed leaves. It is considered as a medicinal plant and used in coughs. Carthamus tinctorius (Sindoorakam). A herb often cultivated. Leaves used to curdle milk in making cheese. Seeds used to remove phlegmatic tumors from the system. Powdered seeds made into a poultice and used to allay inflammation of the womb after

child birth. Roasted seeds eaten and the oil used for dressing ulcers. Dried flowers resemble saffron and are used to adulterate the same. Flowers containing an ingredient called carthamite are used for colouring silk. Oil from the seeds used for lamps, culinary purposes, rheumatic and paralytic complaints. Seeds are laxative and are employed in dropsy. Dried flowers are given in jaundice. *Launaea pinnatifida* (Kadal kozhippa). Often found in the sandy sea-shores. A trailing plant useful as a sand binder. Leaves given to buffaloes to promote secretion of milk. Leaves used externally in rheumatism.

Apart from the above plants a number of ornamental flowering plants belonging to the family compositae are under cultivation in Kerala, viz., *Helianthus* (Suryakanthi), *Zinnia*, *Coreopsis*, *Gaillariad*, *Chrysanthemum*, *Calendula*, *Dahlia* etc.

Goodeniaceae

Scaevola frutescens. Found in the west coast and near the sea at Kovalam and Quilon. A large shrub with large fleshy leaves and white flowers. Juice of the berries instilled into the eyes to clear off opacities and remove dimness of vision.

Campanulaceae

Lobelia Zeyla nica. Found in the hills of Kerala. An erect or more or less prostrate herb with scattered hairs on the leaves. Flowers blue. *L. nicotianifolia.* (Kattupukayila). Found at an altitude of 2500 metres above sea level. A perennial or biennial herb reaching 2 metres high. Flowers white in large racemes. Seeds externally acrid and an infusion of the leaves used as an antispasmodic. Seeds contain an acro-narcotic poison. The dried hollow stalks are used as Kolari horns for gathering cattle herds and for scaring wolves. *Cephalostigma schimperi.* Usually found in shady places or among rocks sometimes in open sandy lands. A slender annual with blue flowers, usually erect and little branched, but sometimes much branched when grown in open sandy lands. *C. hookery.* Found in hills,particularlyat Kumili at an altitude of about 1000 metres above sea-level. A slender herb with blue flowers. *Sphnoclea zeylanica.* Found in swampy places especially near the coast. A

stout herb reaching a maximum height of one metre, with oblong-lanceolate glancous green leaves, and greenish yellow flowers.

Vacciniaceae

Vaccinium leschenanltii (Kalavu). A tree found in sholas in high elevations. Flowers pink in close racemes. Wood used for carving and turning. It is light reddish brown with pretty silver grains. Fruit edible.

Ericaceae

Ganltheira fragrantissima. Found at an altitude of 200 metres above sea level. A large shrub with white of greenish flowers and blue succulent berries. Leaves give an oil which is fragrant and volatile. It has powerful anti-septic properties and is used in acute rheumatism. The oil is externally applied in ointments and is used in preserving vegetables. It is also used as a pleasant flowering agent. *Rhododendron arbooreum* (Kattu Poovarasu). Found in Devikulam about 1500 metres above sea level, in open grass-lands. A tree with beautiful flowers. Wood reddish white, soft, close and even-grained used for gunstocks and fuel. Young leaves are poisonous to cattle.

Plumbaginaceae

Plumbago zeylanica (Vella koduveli). A rambling sub-scandent perennial herb with white flowers and a conspicuously glandular persistent herb with white flowers and a conspicuously glandular persistent calyx. Leaves ovate, membraneous. Root appetizer, used in skin diseases and piles; made into a paste with vinegar, milk or salt and water applied externally in leprosy and other skin diseases. Milky juice of the plant used as application in scabies and unhealthy ulcers. Plant containing plumbagin, which is a powerful germicide, stimulates muscular tissue in smaller doses, stimulates the contraction of the muscular tissue of the heart, stimulates the secretion of sweat urine and bile and has stimulant action on the nervous system. *P. Rosea* (Chuvappu Koduvali). It has large leaves and bright red flowers.

Taken internally, root is a powerful narcotic poison and is employed to produce criminal abortion. It is also used for blistering. Root mixed with oil is externally used in rheumatism, and paralytic affections. It is used in ulcers, cutaneous diseases and leprosy. Tubers soaked in lime water is used to manufacture gun powder. Tubers ground with jaggery and molasses and boiled in coconut oil and given internally dissolves in any part of the body. Root with curd crushed and applied to cure ulcers.

Myrsinaceae

Maesa indica (kriti). Found on waste lands upto 2000 metres above sea level. Occasionally seen in open forests. Roots and fruits have medicinal properties. Leaf used as fish poison. *Embalia ribes* (Vizhal, Vayuvilangom). Found at about 1500 metres above sea-level. A large climbing shrub with small white or greenish white flowers and a globose pepper-corn like fruit. Decoction of root given as a remedy in phlegm, rheumatism, worms, poison, insanity, stomach ache, dropsy, ulcers, cough, heart diseases and constipation. It improves digestion. Seeds powdered and taken for the above diseases as an effective anthelmintic in leprosy, swelling and snake-bite. Dried berries are carminative and stimulant. Seeds which closely resemble black-pepper are largely used for to adulteration and administered orally in piles and are cathartic. Seeds are also used medicinally for gonorrhoea. *Ardisia panciflora*. Usually found growing in evergreen forests from Wynad southwards upto 2000 metres above sea-level. A small tree with white flowers and red berries. Berries yield an yellow dye. Wood moderately hard and useful. *A. Litotalis*. Found along backwaters. A somewhat succulent shrub reaching about 3 ft. in height having rose coloured flowers. The berries red at first turning purplish black. *Aegeceros corniculatum*. Found in sea coasts, in mangrove forests,and along tidal creeks. A pretty small tree or large shrub with ovate coreaceous shining leaves, white flowers and an elongate curved fruit. Wood used for fuel and building huts.

Sapotaceae

Chrysophyllum roxburghii. Popularly called star-apple. A lofty evergreen tree with shining closely nerved leaves. Small greenish white flowers and large yellowish-green berry with hard flat polished brown seeds. *Achras Sapota* (Sapota, chikku). Often cultivated for its edible fruits. *Sideroxylon tomentosum*. Usually found in the hills. A small tree with rather long thorns and small leaves which are bright red when young. The fruit is used in pickles and curries. Wood yellowish brown and hard. *Isonardra villosa*. Found in the west coast. A tree with thick branchlets and coreaceous glabrous leaves. *I. lanceolata*. Found in ever-green forests at about 1500 metres above seal level. Fruits elongate, orange-scarlet. *I. Accuminata* (Panchoonti). A very lofty tall tree. The exudation from the trunk is similar to the guttapercha of commerce is tapped from the incision made on the bark. It is used as wood-cement and exudes perfume when heated. Madhuca *indica* (Iluppa). A tall tree. The large fleshy cream coloured corollas contain much sugar and is an important article of food. It is also used for the distillation of spirit. The large ovoid greenish fruits have large fleshy cololadoms which give a valuable oil. Wood is of good quality. The oil from seed is useful for application in skin diseases. It is also used for adulterating ghee, for burning and for candle and soap making. The spirit obtained from the petals is a powerful diffusible stimulant and is an astringent tonic and appetiser. When the spirit is matured it acts like brandy. The bark is a remedy for rheumatic affections, rubbed on the body it cures itch. The residue cake after the extraction of oil is used to poison fish. Bark yields a green substituted for Guttapercha. M. *Malabarica* (Attiluppa). Fruits of this tree is given in rheumatism, billiousness, consumption, asthma and worm. Oil from seeds used in rheumatism and for improvement of the hair. Soaked flowers used in kidney complaints. *Minusopa elangi* (Ilanji). Tree found everywhere in low country as well as in the hills. Decoction of bark is useful astringent. Dried and powdered flowers used as a snuff. Powdered leaves applied in headache. Juice of bark and unripe fruit is used by silk dyers to fix colours. A sweet-scented oil is distilled from the flowers.

Ebenaceae

Maba buxifolia (Irumpala). Shrub found in dry ever-green forests of south Kerala. Fruit edible. Wood is used for making furniture. *Dispyros peregrina* (Panicha). Commonly called as wild mangostin. A tree with large coriaceous leaves which are bright red when young. Juice of fresh bark useful in bilious fever. Unripe fruit is astringent and ripe ones beneficial in leprosy and gonorrhoea. Oil from the seeds is a laxative and also used for burning and painting. Rind and fruit and bark have astringent properties. Decoction of the same given in chronic dysentery, diarrhoea and internal haemorrhages. *D. Assimilis* (Karinthali). Known as Malabar ebony. A tree commonly found 500—1000 metres above sea level, at Aryankavu and in some other forests of Kerala. Wood is very valuable for furniture, cabinet work, piano keys, opium pipes and carved works. *D. Candolleana* (Krismarom). Large evergreen tree in the evergreen forests like Thenmala and Aryankavu. Root bark powdered or in decoction taken to cure various swellings and rheumatism. *D. Ebenum* (karumkali). A moderate-sized tree, wood very hard, black in colour and known s the Ebony wood of India. Wood valuable for furniture, cabinet manufacture and carvings.

Symplocaseae

Symplocos spicata (Paachotti). Shrub or tree found in the evergreen forests and sholas upto 2500 metres above sea level. Wood used for fuel and seeds put round children's neck to avert evil. Bark used in medicine. Leaves yield a dye. Powder of bark given in honey to cure biliousness, impure blood, haemorrage, diarrhoea, thirst, poison and gonorrhoea. It cures, eye diseases. Paste of leaves boiled in oil is used for treatment of disorders of the head. *S. macrophylla* (parala). A tree found in the evergreen forests like Aryankavu, Thenmala and Kulathupuzha, at about 750 metres above sea-level. Wood is suitable for making match boxes and splints.

Oleaceae

Jasminum sambac (Mallika, Cherupichakaom). A climber

often cultivated in gardens. Flowers yield a fragrant oil. Leaves and flowers are medicinal. Leaves boiled in oil used to anoint the head in eye ailments and to strengthen the vision. Flowers are used to prepare an oil used as a medicine for polypus. Flowers are applied unmoistened to breasts to arrest secretion of milk in puerperal state in cases of threatened abscess. Dried leaves soaked in water and made into a poultice used in indolent ulcers.

J. multiflorum (Karukutty mulla). Cultivated in the gardens. Flowers lactifuge, and applied to the breast to arrest the secretion of milk. Dried leaves soaked in water and made into a poultice applied to ulcers. Root of the wild variety used in snake bite. *J. rottlerianum* (Kattu mulla, Vana mallika). A creeper. Léaves ground and boiled in oil applied to eczema of children as an effective remedy to purify blood. Flowers not so fragrant but like the leaves have medicinal value. *J. arborescens*. (Nagamalli). Commonly known as the Jasmine. A large shrub under cultivation. Flowers yield an oil by distillation. Juice of leaves used as an emetic. Seeds eaten during famine period. Juice of leaves used with pepper, garlic and other stimulants used for removing obstruction of the bronchial tubes by viscid phlegm. *J. Officinale var. grandiflorum*. (Pichakom). An often cultivated shrub because of its fragrant flowers. Leaves chewed as a treatment for ulcerations or eruptions in the mouth. The fresh leaves applied to corns. An oil prepared with the juice of leaves poured into the ear is storrhoea. A perfumed oil is prepared from the flowers. Flowers used as an application in skin diseases, head-ache, poor vision and in scorpion sting. *Nyctanthus arbotristis* (Pavizhamalli). A shrub often found throughout the state. Decoction of leaves prepared over a gentle fire, recommended as a specific for obstinate sciatica. Bark eaten with betel-nut and leaf to promote the expectoration of thick phlegm. Decoction of bark given to cure consumption, eczema, bile, ulcers and itches. Juice of leaves boiled in oil has the same qualities and is used in witchcraft. Leaves contain Nyctanthene and are useful in bilious fevers. Juice and fresh leaves is a purgative to children and is an anthelmintic. Powdered seeds used to cure scurvy and affections of the scalp. Bark used in tanning and flowers yield a dye. *Olea dioica* (Idana). A

tree common in the deciduous and evergreen forests upto about 1500 metres above sea-level. Leaves and bark bitter and astringent. Fruit eaten. Wood used for making agricultural implements. *Myxopyrum smilacifolium* (Chathura mulla). A climber found in the evergreen forests like Aryankavu. Leaves powdered and eaten in ghee as a remedy in asthma, cough, rheumatism, nervous complaints and consumption. Leaves ground and boiled in oil applied in fever, head-ache, ear diseases and back aches.

Salvadoraceae

Salvadora persica (Ukki). A small tree seen in the dry forests. Often found in the hills of the Tamilnadu border. Pieces of root used as tooth brushes. Fresh root bark applied to the skin acts as a stimulant. Decoction of bark used in low fever and amenorrhoea. Shoots and leaves are used as antidote to all poisons. Juice of leaves used in scurvy. Leaves heated and applied in rheumatism. Fruits have aromatic smell and are carminative and diuretic.. They are administered in snake bite. Fruit is also said to be purgative. Leaves, peduncles and fruits contain a large quantity of essential oil. Fruits are edible. *Azima tetracantha* (Asthanku). Often cultivated in houses for medicinal purposes. Leaves considered stimulant, given to women immediately after confinement. Leaves administered with food as a remedy for rheumatism and the juice used to relieve cough. Root has similar properties and given in dropsy along with other drugs. Decoction of bark leaves and root given with other ingredients in diarrhoea. Bark is used as an expectorant.

Apocynaceae

Carissa carndas (Mullikkai). A large thorny shrub often found in the low country and in dry forests. Fruit used in dying and tanning. Unripe fruit is astringent and useful in bilious complaints. Root is stomachic. Fruit used in *Lauha Rasayana* for obesity. Paste of root bark applied to swellings. *Rauwolffia Serpentina* (Sarpagandhi, Amalpori). Widely cultivated due to its medicinal propeties. Usually seen in hills of Kerala upto a height of 1000 metre. Root used in dysentery and bowel complaints and decoction given in snake bite. Root febrifuge

and contains an alkaloid called Pseudobrucine. Root is given internally to promote delivery. An active principle called Sarpasil is extracted from the root and it is used to check high blood pressure. *R. densiflora, R. recurva, R. micrantha, R. beddomei* are the other species found in Kerala. They are not used for medicines. *Hunterial legocii.* A tree found in evergreen forests upto 1000 metres above sea level. It is also seen in Aryankavu. Wood of this tree is used for engraving. Leaves used externally for wounds and cuts. *Cerbera manghas* (Othalam). A small tree found along canals and back-waters. The kernel of the seeds contain a virulent poison which causes vomiting and purging and in most cases death. Fruit used to kill dogs. *Vinca pusilla. A very small annual herb common in waste lands of* Kerala. Decoction *of* dry plant boiled in oil is rubbed on the *loins in cases of lumbago. Recently an extract from thisplant is used to cure some type of cancer. Vinca* rosea (Ushamalari, Smasana poovu). This is also an annual herb, found as weeds in waste-lands. This plant gives an active principle used to cure cancer. This plant is now in great demand in foreign countries. *Plumeria acutifolia* (Ezha chempakam). A tree cultivated in temples and in gardens. Also seen in wild conditions. Bark used to cure gonorrhoea. Poultice of leaves used to dispel swellings. Blunt-ended branches introduced into the uterus to procure abortion. Flowers fragrant. *Alstonia scholaris* Ezhilampala). A tree found throughout low country and in hills upto 700 metres above sea-level. Wood used for making packing cases, tea-chests, furniture, black boards etc. Bark bitter and contains an active principle called detain which is as efficaceous as quinine in fever with fewer aftereffects. Bark is also used in chronic cases of diarrhoea and dysentery. Poultice of leaves used for ulcers. The charcoal is used to prepare gun powder. *Holanhena antisenterica* (Kudakappala). A tree often found in low country and in hills. Bark bitter, astringent; used as a remedy in piles, dysentery, bile and leprosy. It is an expectorant, antidote to poison, cures urinary and skin diseases. Wood used for carving, furniture, toys etc. *Tabernaemontana dichotoma* (Pala). A shrub or a small tree, common everywhere in the low country. and in the hills. The soft wood is used for engraving. he milky latex of this tree often used as a substitute for gum.

T.Coronaria(Nanthyarvattom). A shrub, often cultivated for its beautiful white flowers. Juice of leaves applied to the eyes to cure ophthamia. Juice of flower mixed with oil used to relieve the burning sensation of the eye. Milk of the plant is very cooling and applied to wounds prevent inflammation. *Thevetia peruvianan* (Manja arali). Often seen in the low country in waste lands. Sometimes cultivated in the gardens. A shrub or a small tree. Bark is a drastic purgative. Fruit emetic and useful in intermittent fever. Milky juice highly poisonous. Seeds yield an oil. *Vallaris solanacea.* A twining shrub. The milky juice is employed as an application to wounds and old sores.

Wrightia tinnctoria(Thattan chavana, Aiya pala). A tree found throughout the deciduous forests. Fresh leaves very pungent and chewed as a remedy in tooth-ache. Leaves lose this property when dried. The indigo prepared from the leaves is called pala-indigo. Wood used for carving and turning. Bark is used as a tonic and seeds as an aphrodisiac. Wood suitable for match-boxes and splints. *W. tomentosa* (Nilampala). A small tree found in the deciduous forests of low country. Wood used for turning and carving. Bark, stem and roots administered for snake-bites and sting of scorpions. *Nerium odorum* (Arali). A plant often cultivated in gardens and temples. Decoction of leaves given to reduce swellings and an oil prepared from the root bark used in skin diseases and leprosy. There are two varieties;one with white flowers and the other having red flowers. Fresh roots of the white variety is poisonous as also the leaves; bark and flowers. Bark contains two resinous bitter poisons. The antidote for this is buffaloe's milk, curd and sugar given frequently or in immediate use of any emetics. *Strophanthus wighianus* (Aana vazha, Kumbatti). A shrub found in the coast of Kerala. *Chonemuspha macrophylla* (Appuppan thadi). A climber found throughout the country. Root and stem powdered and given in honey rheumatism, blood-fortifying, gonorrhoea, chest diseases, leprosy, itches and fever. *Ichnocarpus frutescens* (Palvalli). A large climber found all over the low country. Root used as substitute for a very rare herb called — mahameda — in the preparation of *Amritha-prasa ghritha* for increasing vigour. Leaves and stalk boiled in oil applied to cure fever, head-ache and high temperature.

Asclepiadaceae

Hemidemus indicus (Narunandi). A twining shrub found all over the country. Milky juice poured, into inflamed eyes causes copious lacrimation and afterwards a cooling sensation. Root applied as a flavouring agent in pickles and chutneys. The sarsaparilla essence extracted from the root is a fragrant tonic useful in dyspepsia, loss of appetite, fever, skin diseases and ulceration of syphilitic origin. *Cryptolepis buchanani* (Kalipal valli). A climber often found in teak plantations. Stem yields a fibre fit for cordage and cloth. The plant is to cure rickets in children.*Calotropis gigantea* (Erukku). A shrub found in dry waste places in the low country. Milky juice used for ring-worm and tooth-ache. *Asclepias curassavica* (Chemmooli). Often grown in gardens. In the wild condition it is found in the foot of hills of Puliyara, Aryankavu etc. Root used as a remedy in piles and gonorrhoea. Juice of leaves used for arresting haemorrhages. *Pergularia extensa* (Veliparuthi). A climber often found alongside fences. Infusion of the whole plant given in pulmonary affections. Large doses cause nausa and vomiting. Stem yields a very fine and strong fibre. *Holostemma annulare* (Adapothiyan). A creeper found in most of the villages in Kerala. Root pulverised and applied to eyes to remove dimness of vision and used in ophathlmia. Leaves boiled with salt and chillies eaten as vegetable. *Sarcostemma acidum* (Somalatha). A leafless trailing shrub found in the evergreen forets. The plant has religious importance and used in '*Yajnas*'. The plant contains a milky juice and the tender shoots are sucked by travellers to allay thirst. *Tylophora tenuis* (Nanjaruppan). A slender twiner often found along backwaters. Decoction of root given as an antidote to arsenic poison. It relieves perspiration, bilious swellings and small pox. Also considered as an anti—venom. *Tylophora indica*(Vallippala). A twiner usually found in the forests. Root has properties of ipecauanha and is a good remedy. Leaves used to cure asthma., Powder of dried leaves induces perspiration, removes phelgm from the throat and cures bowel disorders. Root pulped and boiled in coconut oil given to children, suffering from eczema and worms. *Cosmostigma racemosa* (Vattuvalli). A twining shrub. Leaves used to cure ulcerous sores. Root bark administered internally in dyspepsia.

Flowers sweet and eaten by local people. *Wattakaka volubilis* (Wattakakkakodi, Kodipala). A climber. Root applied in snake—bite and given to women to cure head-ache after child birth. Leaves edible. Leaves used as an application to boils and abscesses. Roots and tender stalks considered emetic and expectorant. · Entire plant used in the treatment of colds and eye diseases.

A few species of the genera Leptodeni, Ceropegia, and Caralluma, are seen growing in some of the forest areas of the State.

Loganiaceae

Strychnos nux-vomica (Kanjiram). This tree is commonly found throughout the low land. Wood used for axe handles, plough shares, cart wheels, cots and fancy cabinet work. Being bitter it is resistant to white ants. Seeds contain strychnine and brucine. Nux-vomica is a powerful nervine tonic and a stimulant to the spinal cord. Juice of fresh bark given in cholera and dysentery. Decoction of leaves applied in paralysis. Decoction of root administered orally to cure ring worms, brain disorders, poisons, insanity and swellings. Leaves used as a manure. *S. Colubrina* (Cherukanjiravalli, Modirakanjiram). A climbing shrub commonly found at Kulathupuzha, Ponmudi, Aryankavu, Pathirappalli and in ever-green forests. Wood is said to be an infallible remedy in snake-bites. Used in fevers, as an anthelmintic and in cutaneous diseases. Root is purgative and an excellent bitter tincture is prepared from the plant. *S. Potatorum* (Thattanparal). A tree seen in the dry forests. Wood used for ploughs, buildings and cart wheels. Seeds not poisonous and used to clear muddy water. Seeds used by native practitioners in the treatment of eye—diseases. *S. cinnamonifolia* (Vallikanjiram). A gigantic climber in the ever—green forests at about 750 metres above sea-level. Root in decoction boiled with oil applied in rheumatic ulcers, elephantiasis, fever and epilepsy in children.

GENTIANACEAE

Canscora decurrens. A slender erect herb with pink or

white flowers seen amidst grasses in South Kerala. ***C. wallichi.*** An erect herb reaching about 40 cm., with rose coloured flowers found in grass lands at 2000 metres above sea--level. ***Memuamtjis crosta;a*** (Neyyambal). A small floating water plant found in all districts of Kerala, in tanks and ponds and in ditches.

BORAGINACEAE

Cordia dichotoma (Virasham). A moderately sized deciduous tree with white flowers common in all deciduous forests. Juice of the bark with milk used for stomach -ache. Leaves after removing juice rubbed on face as a remedy for acne. Fruits edible and used as vegetable and for making pickles. **Coldenia procumbens.** A procumbent herb with trailing stem lying flat on the ground and is found in all plains on moist ground, on the margins of tanks and in rice-fields during dry season. Heliotropium Scabrum (Ellida). A much branched woody herb growing in tufts found in all plains on sandy lands, waste places, road-sides, etc. H. ***Indicum.*** A coarse annual herb reaching half-a metre in height found in all plains, road-sides and in waste places. **Trichodesma indicum** (Kazhuthathumba). An erect hispid annual herb found in all dry waste lands and on road-sides.

CONVOLVULACEAE

Agyreia *tiliaefolia.* A diffuse climber with large handsome rose-purple flowers, leaves upto 12 cm. in diameter. **A. populifolia.** A rather slender climber with rose-purple corollas found in most of the places in Kerala. ***A. Fulgens.*** A silky silvery shrub with dark purple corollas found about 1000 metres above sea-level, in W. ghats, Anamalai and in other hills. **Ipomoea calycina.** A slender twiner with pink flowers in slender cymes found in W. ghats, Wynad and hills of Kerala, upto an elevation of 1000 metres above sea-level. ***I. Pileata.*** A well-marked annual trailing herb with yellowish or white flowers found in W. ghats, Anamalai, and hills of Cochin. ***I. aquatice.*** An annual or biennial pretty water plant often floating on the surface found on the margin of tanks and in other wet places. Juice is used as an emetic and arsenic opium poisoning. *I.*

Obscura. A twining or trailing annual with yellow or white flowers with purple tuber often found in all plains in grasses and hedges. *I. Campamulata*. A large climber white or pale rose flowers found in the hills of W. ghats, upto 1000 metres above sea level. Used as an antidote to snake poisoning. *I. biloba* (Adampuvalli). An extensively creeping and sand-binding plant with a thick root, stock, found in sandy shores and sandy river banks. Flowers purple red. The plant is commonly known as railway creeper. *I. quamoclit* (Kamalatha, Akashmulla). A twiner commonly found either cultivated or in wild state in unattended places. Powdered leaves applied to bleeding piles and taken orally. *I. panicenlata* (Palmothakku). A large perennial climber with pink or red purple flowers. Often cultivated or of wild growth. Stems and leaves eaten by cattle. Root is tonic, aphorodiasic, demulcent and lactagogue. Powdered root acts as purgative. *I. batatus* (Kappakizhangu, Cheerikizhangu, Madhurakizhangu). A creeper cultivated extensively. Root tuber is largely eaten as a subsidiary food. *I. Pestigiridis* (Pulichuvatu, pulinghavalli). The leaves of this creeper look like a palm of a tiger. The plant is found in low country. *Merremia tridentata* (Prasarini, Tiruppan pullu). A prostrate herb found all over the low country in waste places. The whole plant powdered or boiled in oil used for rheumatism, piles, swellings and urinary disorders. It improves vitality and is a laxative. *Lepistemon leicalyx* A villous climber with yellow flowers, found in W. ghats, in Konni, Wynad, and other hilly areas of Kerala. *Porana malabarica*. An extensively ramified climber slender branches and with white flowers found in W. ghats and other hills in Kerala. *Evolunlus absinoides* (vishnukranthi). A perennial herb with woody root stock and many spreading wing branches with light blue flowers found in all plains, in open grounds, by roadsides and in dry greasy places. It is used as a febrifuge with cummin seed and milk as an alternative and with oil to promote growth of hair. *Cuscuta chinensis*. A very slender stemmed parasite and is found at most of the places in the State.

SOLANAECEAE

Solanum nigrum. (Manathakkali). An erect annual herb

on all district at all elevations. A cosmopolitan weed of roadsides and cultivated land. Juice of the berry is given in chronic enlargement of the liver and acts as a hydrogogue cathartic. Fruits roasted, powdered and smeared with ghee is a remedy for piles, fever asthma, impure blood, vomiting and gonorrhoea. Fruits cooked or fried, eaten as a vegetable. **S. Pubescens** (Chundakka). Usually low, but occasionally large shrub found in W. ghats, in open scrub forests on arid soil upto 1000 metres above sea level. Fruit used as a vegetable. **S. Ginganteum** (Cheruchunda). A large shrub or small tree reaching a height even 6 metres, found in W. ghats at 1500 metres above sea level. Fruit used as a vegetable. ***S. Indicum*** (Putharichunda). Found in all plains, on waste places, roadsides, etc. A very prickly undershrub with dark yellow berries. Seeds used as remedy for tooth-ache. Root forms one of the ingredients of ***Dasamoola***. Fruits used medicinally for piles, diaorrhoea and dysentery. ***S. melongena*** (vazhuthana). A well known vegetable. It is a remedy perennial conspicuous herb in all plains and low hills, a weed of **roadsides** and waste lands. Root medicinal an ingredient of the ***Dasamoola*** and used in cough, asthma, and pain in the chest. ***Lycopersicum esculantum*** (Tomato, Thakali). Cultivated for its fruit. ***Physalis minima*** (Njodunjotta). A herbaceous annual in all districts as a common weed of undergrowth, on roadsides and in waste places. Ingredient in a medicinal oil which is given for enlargement of the spleen. Fruit is said to be a tonic, diuretic and purgative. ***Withania somnifera*** **(Amukkuram). An erect branching undershrub reaching abut 2 metres in height found in dry localities of the State. Often cultivated for its medicinal properties. An alkaloid called "Somniferine" is isolated from the plant. Leaves and root have diuretic tonic and alternative properties, used in consumption.Root, used as an antidote to poison.** ***Nicandra physatoides*****. A shrub in evergreen forests found at Udumbanchola. The whole plant is said to have diuretic properties.** ***Datura metel*** **(Ummam). A large annual somewhat succumbent herb with zig-zag stems found in almost all districts, in gardens and in waste lands and roadsides. Juice of fruits with opium and oil applied in parasitic skin diseases and to destroy lice. Seeds are used in the fermentation of country spirits. Smoking of dried leaves and stem relieves asthma. Seeds**

contain an alkaloid "daturine" used in asthma, bronchitis, insanity and ophthalmia. *Nicotiana tabacum*. (Pukayila chedi). A cultivated shrub, leaves used for smoking, chewing, snuff making and for extraction of "Nicotiamin" which is a poison.

SCROPHULARIACEAE

Celsia coromandaliana. An erect, grey pubescent annual with yellow flowers in a branching inflorescence found as a weed in cultivated fields. *Adenosma subrepeus*. A trailing herb, rooting at the nodes, flowers bluish purple. Found throughout the State. *Limmophila indica* (Menganari). A very variable erect, or prostrate or floating plant, rooting at the nodes. Flowers of violent pink colour found in West coast in wet places, rice fields etc. *L. Hirsuta*. A tall plant reaching about 6 metres in height found in the west coast districts and lower hills in wet places. *L. hypericifolia*. A tall glabrous herb reaching 2 feet in height with rose-purple flowers. Found in the W. ghats and in the hills of Kerala upto an elevation of 2500 metres. *L. Heterophylla*. A rather tall erect herb. Found in ponds, ditches, stagnant water and in rice fields all over Kerala. *Bacopa monnieri* (Nir Brahmi). A somewhat creeping succulent herb with blue flowers found in all districts. Usually seen on the hills upto about 4000 feet in wet places, even in saltish water. The entire plant is medicinally valuable as nervine tonic and in insanity. Leaves and stems are diuretic. Juice mixed with petroleum rubbed in rheumatism.*Artanema sesamoides* (Vathamvaratti, Nir mulli). A stout erect herb or undershrub about a metre high found in Kulathupuzha, Konni, Quilon and Wynad. Decoction of root given in rheumatism, phlegm diarrhoea, indigestion, stone in bladder, syphilis and ophthalmia. It increases vitality. Powdered leaves or decoction given to cure rheumatism, dropsy, poisons. Seeds powdered in ghee cure biliousness and impure blood, improve vitality and favour conception.*Torenia cordifolia*. A low erect trichotomously branching herb found in W. ghats. *I. bicolor* (Kakkapoo). Found in wet places. A small triling and rooting herb with small leaves and the corolla with dark blue or diolent upper and white lower tip. *T. travancorica*. A creeping annual herb with large

flowers, white with blue blotches on the lobes of the lower lip found in W. ghats and in the hilly areas of Kerala. ***T. vagans.*** (Ponnanpoo). A diffuse trailing and rooting herb with pale blue corolla having darker blotches on the lobes of the lowe lip. Found in W. ghats at about 200 metres above sea level. ***T. Fournieri.*** This is an introduction from Vietnam. Frequently grown for its showy flowers of a pale blue with bright purple blotches on the lobes of the lower lip and yellow in the throat and tube. ***Scoparia dulis.*** A glabrous undershrub sometimes growing upto 1 metre height with small white flowers. Found in all plains and at about 1000 metres above sea level.It is an exotic plant, now common in all waste lands and fallow fields. ***Striga gesneroides.*** A parasitic plant found on the roots of various plants, mainly on Euphorbia antiquorum. Found in Western ghats and in northern districts of Kerala in an elevation of above 2000 metres. **S. lutea.** An erect scabous hirsute branching parasitic herb, usually pale when dry. Found in hilly areas of the State, in wet places and in rice fields. ***Centranthera hispida.*** An erect herb reaching about 50 cm. in height. Found in wet places and among crops.

OROBANCHACEAE

Aeginetia indica. Parasitic herb of a purplish red colour. It grows apparently on the roots of many different plants. Found in the hills of Kerala upto 1000 metres above sea level. ***A. Pedunculata.*** Parasitic on the roots of grasses. A redish or yellowish herb with short underground stem. Found in hilly areas upto 1000 metres above sea level.

A. Acaulis and ***Christisonia keralense.*** are two new species of the family orobanchaceae, recently reported from Ponmudy and Nelliampathy respectively.

LENTIBULARIACEAE

Utricularia fasciculata. An aquatic plant with yellow flowers with larger peduncles found in the west coast in rice fields, tanks, and other wet places. ***U. Ulifinosa*** (Seethashru) commonly known as bladderwort. A stroking and interesting insectivorous

plant. Flowers with blue-violet corolla. Found in W. coast in rice fields climbing up the stem of rice. *U. bifida*. An erect rigid slender herb with yellow flowers, filiform leaves, and two horned small bladders on threads at their bases. Found in Quion and other places of South Kerala.

GESNERIACEAE

Didymocarpus rotteriana. A large herb with many scapes and purple flowers, yellow in the throat. Found in the hilly regions of Kerala. *D: tomentosa* (Elichuzhiyan). A herb with bluish purple flowers. Found generally in rocky slopes of Travancore. *Klugianotoniana*. A nearly succulent annual herb reaching about 50 cm. in height with rather large flowers white in the tube, the large lower lip bright blue with yellow near the catities at the base. Found in Western Ghats. *Rhyncoglossum obliqum*. A succulent herb with blue flowers, similar to the above species but smaller and with the calyx not winged. Found in Western Ghats near Cochin, upto 1000 metres in damp places in evergreen forests. *Isanthera permollis*. An erect undershrub with smooth pale brown bark, and small white flowers. Found in W. ghats, S. E. Wynad and in other northern districts, in moist evergreen forests.

BLGNONIACEAE

Oroxylum indicum (Palakapayyani). A small conspicuous tree found in evergreen forests of Kerala, upto 700 metres above sea level. Bark is an astringent tonic. Root bark contains oroxylin and citric acid and is used in diarrhoea and dysentery. The tender fruits are carminative and stomachic. The whole plant used in Asthma and fever in children. Green leaves used in ulcers. Bark and fruit used in dyeing and tanning. *Millingtonia haritensis* (Maramalli). Commonly known as Indian cork tree.

A tall handsome tree with sweetscented flowers. Bark thick and corky. Found in all plains, planted in avenues and gardens. *Dolichandrone spathacea* (Nirpongilium). A medium sized deciduous tree with pretty white flowers, which blossom at

night and then fade. Found on the banks of rivers and backwaters. Seeds with ginger and pavetta root are administered in spasmodic affections and decoction of bark is used for preserving fishing nets. *Steriospermem tetragonam* (Pathiri. Karinkara). A large tree with yellow flowers veined with red found in W. Ghats in most of the places upto 1000 metres above sea level, chiefly in deciduous forests. Bark and flower with sugar and water given in chronic dyspepsia. Wood used for house construction, furniture. canoes and tea chests. *Pajanetia rheedii* (Arlantha, Payani). A large deciduous tree in the forests, usually planted as a support for pepper plant. Wood used for dug-out canoes and catamarams. **Spathodea campanulata.** A lovely tree introduced from tropical Africa, with large orange-scarlet flowers. Planted as an ornamental tree in gardens.

PEDALIACEAE

Pedalium murex (Kakkamullu, Ananjeringil). A branching subfleshy herb grown as a weed throughout the sea shores of southern districts of Kerala. Fruit used in the disorders of the urinary system. Pqwder or juice of leaves taken to cure skin diseases. Decoction of the white plant given for rheumatism. piles, impure blood and worms. It is used to adulterate buttermilk. ***Sesamum indicum*** (ellu) cultivated throughout Kerala for the oily seeds. Oil is used for various purposes and the oil cake given to cattle.

ACANTHACEAE

Thumbergia fragrans: A slender twiner with variable leaves. Flowers not fragrant. Found in all districts, especially on the eastern side upto about 1500 metres above sea level. T. **alata, T. mysorensis**, T. **grandiflora** are other species generally found in the gardens of Kerala. *Nelsonia Campestris.* A soft trailing herb with purplish flowers found in Northern and Southern districts of Kerala at low elevations. *Acqnthus ilicifolius* (Chakka mullu, Kozhimullu). A gregarious shrub reaching 5 feet in height with large blue flowers and spinous leaves found near the

bckwaters of central Kerala and in northern districts. *Asteracantha longifolia*. (Vayal chulli, Neermullu). A tall herb with pale blue purple flowers found in all wet places, rice fields, margins of tanks etc. Seeds given for gonorrhoea, and with milk, sugar in spermatorrhoea. Leaves roots and seeds employed for jaundice, dropsy, rheumatism, anasacra, and disease of the urogenital tract. *Dipetracanthus prostratus* (Adapathiyana). A diffuse undershrub with solitary pale blue or purple flowers. Found in most bushy dry places on banks, in gardens etc. Juice and leaves boiled with salt used to correct depraved state of the humours and is given with liquid copal in gonorrhoea. *Strobilanthus ciliatus* (Kurinji). Found in the hills, in Munnar, Kumily, etc. A gregarious bushy shrub with blue flowers colouring large tracts when in flower at intervals of about six months. *Andrographis paniculata* (Kiriyathu, Nilavepu). An erect herb with pink corolla seen at southern Kerala as dry forest undergrowth. The whole plant is bitter, root has tonic, stomachic and alternative properties and its tincture is stimulant and effective in influenza. Leaves used in diarrhoea in children and as anthelmintic. Fresh juice given in fever, and with black pepper, rock salt and asafoetida given in colic. Decoction of whole plant is given to cure impure blood, asthma, swellings, worms, gonorrhoea, piles and consumption. *A. echioides* (Gopuram thangi). An erect herb, very common in the State. Juice of the plant administered in fever. *Crossandra infundibuliformis*. (Kanakambaram). A pretty undershrub growing upto a height of one metre with orange-yellow flowers found in ghats, in open forest land and commonly planted in gardens. Used as an aphrodisiac. *Barbaria mysorensis*. A small prickly shrub with blue or purple flowers, spines usually long. Found in almost all dry places in the State. *B. paniculata*. A pretty shrub with rose pink flowers found in the foot of W. Ghats, in Malabar, Cochin and Travancore, in dry places. *B. Cristala* (Rose Kanakambaram). Found in all dry places. Often planted in gardens for its beautiful rose flowers. *B. Strigosa* (Neela Kanakambaram). Cultivated in gardens. *B. Courtallica* (Venkurinji). A shrub upto a height of about one metre with large blue flowers at low elevations and found at Konni evergreen forests. *Asistasia gangetica* (Lavana valli). A straggling, often somewhat climbing perennial herb found everywhere in the

woods. with purple or yellow flowers. Juice of the plant anthelmintic given in swellings and rheumatism. ***A. travancorica.*** A large shrub with narrow leaves found in the hills of S. Kerala.

A. Crispata. A branching herbaceous undershrub with crispata leaves found in W. **Ghats** in Shola forests. ***Justicia diffusa*** (Cherupullady). A slender herb with pale flowers, found in almost all places in the State. ***J. gendarussa*** (Vattamkolli, Karutha Koonthani). An erect undershrub. Corolla white with purple spots. Found in W. Ghats. Leaves roasted and eaten in chronic rheumatism. Oil prepared from leaves is used in eczema and facial paralysis. Oil prepared from leaves is used in eczema and facial paralysis. Juice of leaves used in ear-ache and cough, remedy in colic of children. Leaves with mustard used as emetic and heated with salt, applied in relieving stiffness of joints. Leaves have insecticidal properties also. **Adhatoda vasika** (Aadalodum). A dense shrub with a facial scent. Flowers white with the throat barred with white or yellow. Leaves used as a medicine for rheumatism. The entire plant is useful medicinally in the treatment of cough, asthma etc. Juice of leaves used in diarrhoea and dysentery. Charcoal of wood is used for making gun powder. **A. beddomei.** A very large shrub with small flowers in short heads found in hills of southern Kerala at an elevation of 1000 metres. ***Rhinacanthus nasutus*** (Naga malli). A shrubby plant reaching a height of about two metres. Flowers white. Found in almost all districts, particularly on roadsides.

VERBENACEAE

Lantana camera (Poochedi, Aripoo). An aromatic plant. Corallas normally **orange**, but plants found in gardens have various hues from white to dark red. Found all over the **state** as a weed. Fruits used to adulterate pepper. ***Lippia nodiflora*** (Neerthippali, Kathuthippali). A prostrate herb with small white flowers having pink tinge. Found in all districts as a weed in wet grounds and grassy pastures. ***Stachytarphata jamaicensis.*** A tall herb with long slender spikes of blue flowers. Found in laterite soil. ***Premna coriacea.*** A large climber with purple

corymbs and white flowers. *P. tomentosa*. A moderate sized deciduous tree with greenish yellow flowers. Found in southern Kerala at an elevation of about 1000 metres. Wood used for carving, fancy work and weaving shuttled. Leaves have medicinal properties. *Clerodendrum inerma* (Neer nochi, Cheruchinna). A straggling shrub found in banks of backwaters in southern districts of Kerala. Roots and leaves have medicinal properties. *C. infortunatum* (Peravalam). A large shrub with large terminal panicles of peduncilata cymes. Found in waste places and hills all over the country upto 1000 metres above sea level. Leaves used as anthelmintic, used as vermifuge, as a bitter tonic and febrifuge in malarial fevers. Bark is also used in medicines. Decoction root bark cures diarrhoea, dysentery and bowel complaints. *Vitex trifoliata* (Vella nochi, Nir nochi). A small shrub with pale purple flowers found on the banks of lakes. Leaves extrenally applied in rheumatism and sprains. Powdered leaves given in fever, asthma, rheumatism and worms. An oil is extracted from the roots. *V. negundo* (Nochi). A large shrub or a small tree with bluish purple flowers. Found in all districts in dry region, upto 1500 metres above sea level in hills, on waste lands, on roadsides and the banks of streams. Root is a febrifuge. Leaves, root and fruit used in medicine. Ashes used as a alkali in dyeing. *Avicennia officinalis* (Kandal). A small tree found along the coast in tidal marshes. Common along backwaters of Trivandrum and Quilon districts. Bark, root and seeds are considered medicinal. Unripe seeds used as poultice to hasten suppuration of boils and abscesses.

LABUATEAE

Ocimum aemricanum (Kattuthulasi). A much branched herb found in waste lands. Medicine for skin diseases, fever, rheumatism and ulcers. Leaves made into a paste used in parasitical skin diseases and applied to the finger and toe nails during fever. Decoction of root given to remove phlegm from the throat in epilepsy and vomiting. Flower inhaled nasally with pepper relieves head ache. *O. basilicum* (Rama Thulasi). A large herbaceous plant with large leaves. It is often cultivated. Juice of leaves is anthelmintic, used in sprains and ear ache. Leaves distilled with water given an essential oil which crystallises

into basil camphor. Root used in bowel complaints of children. Leaves useful in treatment of croup, for which the warm juice with honey is given. *O. sanctum* (Krishna Thulasi). An erect, softly pubescent undershrub considered sacred by the Hindus and hence cultivated on pedestals at most houses. Infusion of leaves given in Malaria, gastric diseases in children and for cutaneous diseases. Leaves used in poojas and also to flavour sauces, wines etc. Dried leaves powdered and used as snuff. Seeds given in disorders of genito-urinary system. Fresh roots, stems and leaves bruised and applied to the bites of mosquitoes. The entire plant is also used in snake-bite and scorpion-sting. *Colens parviflorus* (Cheevakizhangu, Koorka). It is often cultivated for its edible tubers. *C. blumei* The plant carries beautiful coloured leaves in different shades and is often cultivated in gardens. *Anisochidus carnosus* (Karpuravalli, patukurkka). An erect herb often cultivated for its medicinal value. The plant yields a volatile oil which has stimulant and expectorant properties. Fresh juice of leaves with sugar given to children in coughs and colds. *Hyptis suavelones* (Gangatulasi). A tall sweet-smelling herb found in plains on roadsides and waste ground. The plant pounded and applied to parasitical cutaneous diseases. The plant yields essential oil containing menthol. *Anisomele indica*. A shrubby herb reaching about two metres smelling strongly of camphor. Oil extracted from this plant is used in uterine affections. Found in open forests, waste lands and on roadsides upto about 1500 metres above sea level. *A. Malabarica* (Karimthumapa). Common in waste lands and on roadsides. *Loucas aspera* (Thumpa). An annual herb with white flowers found commonly in fields, waste lands and on roadsides. Juice of leaves poured into the nostrils in epilepsy, head ache, poisons and boiled in oil applied to itches. Decoction of root cures rheumatism, phlegm, bowel-complaints, jaundice, swellings, asthma, worms, poison, piles and indigestion. *L. wightiana*, *L. Zeylamica*, *L. linifolia* and *L. helianthemifolia* are some of the other herbaceous species of Leucas found in Kerala.

NYCTAGINACEAE

Boerhaavia diffusa (Thazhuthana). A diffuse herb with stout root-stock and many erect or procumbent branches. A

weed of waste land and roadsides found in all plains and also to some heights in the hills. Decoction of root taken as a remedy in rheumatism, impure blood, cough, asthma, chest-pain, piles and swellings. *Pisonia aculeata*. A large thorny climbing shrub found in forest lands. The juice of the leaves mixed with pepperand other ingredients is given to children suffering from pulmonary complaints. *Mirabilis jalpa* (Nalumani, Anthimalari). Often cultivated in garden for its beautiful flowers. Roots and leaves are medicinal. *Bougainvilae spectabilis*. These Brazilian shrubs are very common in our gardens.

AMARANTHACEAE

Coelosia cristala (Kozhipoovu). Often cultivated in gardens. *Amarnathus spinosus* (Mullan Keera). An erect spinous herb with reddish stems. Found in most of the waste lands, fields and gardens, and on the roadsides. Leaves and roots boiled and given to children as laxative and applied in boils and burns. Decoction of roots and stem remove urinary obstruction. *Cyanthula prostrata*. A slender herb commonly found upto 1000 metres above sea level. *Aerva lanata*(Cherupola). A many-branched undershrub found at all places upto 1000 metres. The plant squashed and boiled in oil given in soremouth. The entire plant is powdered and taken in honey cures cutaneous affections and sugar in urine. *Achyanthus aspera* (Kadaladi). An erect herb reaching 1 metre in height found in all places, on roadsides and in waste places. Root used as tooth-brush. Seeds given in eye-diseases, snake bite, and cutaneous affections. Decoction of the plant is a good diuretic, used in kidney diseases and renal dropsy. In large doses it produces abrotion or labour pain. *Alternanthera sessilis* (Kozhuppa). A prostrate weed found in almost all wet places. Leaves edibile. It increases milk in mothers and also used as a wash for the eyes. Young shoots nutritious and contain 5% protein. *Gomphrena globosa* (Vadamalli). An annual, often grown in gardens.

CHENOPODIACEAE

Chenopolum album. A tall herb reaching about 3 metres in height. Found as a weed on roadsides, waste lands and

cultivated fields. ***Basella rubra*** (Pushalikeera). A glabrous succulent climbing herb often cultivated as a vegetable.

POLYGONACEAE

Polygonum glabrum. Found in ditches and wet places. An erect glabrous annual herb, rooting from lower modes, the flowers pink or white. leaves very slender. Root bulb made into flour used for piles, jaundice etc. ***P. punctatum***. A small annual with white or pink flowers found as a weed in gardens and in cultivated lands and also at hill upto 1500 metres above sea level. Leaves applied to swellings.

PODOSTEMONACEAE

Tristichia ramossima. A floating plant with very long, filiform. much branched stems. Found in the rivers of northern districts of Kerala, and also at Trivandrum district.

ARISTOLOCHACEAE

Bragantia wallichi (Alpan, Thevasi muringa). An erect shrub with grey bark found in the W. Ghats as an evergreen forest undergrowth. Root externally applied in swellings. Plant mixed with oil and made into an ointment said to be beneficial for carbuncles and ulcers. The plant is also considered as a medicine for snake-bite and other poisons. ***Aristolochia indica*** (Easwaramooli, Garudakodi). A perennial twiner at all low levels on hedges and among bushes. Juice of the root applied to the nasal organ in convulsions, and is also an antidote to snake-bite and insect sting.

PIPERACEAE

Piper longum (Thippali). A slender undershrub. Found wild in evergreen forests. Often cultivated. Decoction of seed in honey given in coughs and throat injection. Root useful in paralysis. stiff joints and epilepsy. ***P. betel*** (Vettila). A creeper extensively cultivated. The leaf contains an aromatic oil which yields a phenon called chavicol which is a powerful antiseptic. The leaves rolled up with areca nut, lime cardamom and other

ingredients sold in shops and universally chewed. *P. nigrum* (Nallamulaku, Kurumulaku). Black or white pepper. A stout glabrous climbing shrub, extensively cultivated in the State. A valuable spice. It is also medicine for Asthma, fever, cough and rheumatism.

MYRISTICAEAE

Myristica fragrans (Jathi) Nutmeg.

A small tree extensively cultivated in the State. Oil extracted from the seed is used for rheumatism and wounds. The fruits are aromatic, stimulant, carminative and used as condiments and flavouring agents. Seeds if chewed remove bad breath and improve complexion but constipate bowels. *M. malabarica* (Kattujathikka). A tree reaches about 15 metres in height. Found in evergreen forests upto 400 metres above sea level. Seeds yield an oil used as an ointment for cleansing ulcers and applied in rheumatism. Also used in ear—aches. Wood suitable for match boxes.

LAURACEAE

Cinnamomum zeylanicum (Vayana, Karuva). A moderate sized tree found in most places in the low country. Bark is the cinnamomumbark of commerce and used as a condiment. Leaves yield an oil used in perfumery. *C. Camphora*. Camphor tree (karpoora maram). An exotic from Japan, now is cultivated in various places in India. The plant has sedative properties. Used in insecticidal preparations. Litsea Coreaceae(Maravattiithali, Pannithali). A small tree with leaves often green above and dull grey beneath. Found in the evergreen forests of Travancore upto a height of about 1000 metres. *L. Zeylanica* (Mulaku chempaka pala). A tree found in the evergreen forests of Kerala. *Cassytha filiformis* (Akasavalli). A parasitic leafless twiner commonly found growing on various young trees and bushes, mostly near the coasts. Plant powdered and mixed with gingelly oil used as a hair tonic. Mixed with butter and ginger used for cleansing ulcers. Juice of the plant mixed with

'sugar is considered a specific in inflammation of the eyes. Also considered as a medicine for bilious affections and for piles.

LORANTHACEAE

Dendrophtoe falcata (Ithil). A large parasitic plant commonly found on mango trees. Juice of the plant applied in ear aches. Used for wounds and menstrual disorders and also as a remedy for consumption, asthma and mania. *Viscum articulatum*. A parasitic shrub found growing on forest trees. A preparation from the plant is given in fever with aching limbs.

SANTALACEAE

Santalum album (Chandanam). Wood ground up with water into a paste applied to the temples in head-ache and fevers, and to skin diseases to allay heat.

EUPHORBIACEAE

Euphorbia heterophylla, *E. pettata* and *E. rosea* (Nilampala) are perennial herbs found as weeds in various places. *E. Thymifolia* (chitrapala) is a prostrate herb found all over the country. Dried leaves and seeds given to children in bowel complaints. Juice of plant used for ringworm, in snake bite and skin diseases. *E. tirucalli* (Thirukalli). A large shrub or small tree found cultivated as hedge plants. Also considered as an ornamental succulent. Milky juice applied for warts, rheumatism, neuralgia, tooth-ache, in cough, asthma and ear-ache. Also used as fish poison. Though a native of Africa, it is naturalised in dry regions of the State. *E. nerilifolia*, *E. nivulia*, *E. hirta*. *E. prostrate* *E. microphylla* are some of the other species of the genus common in Kerala. **Bridelia retusa** (Mullu venga, Mukkayini). A moderately sized tree with conical thorns on the stems and branches when young. Found in deciduous forests near the streams or ravines. **Cleistanthus travancorensis** (Nandi) A small tree found in the evergreen forests of Kerala. Yields a valuable timber as good as teak. Fruit, leaves and bark poisonous.

Emblica officinalis (Nelli) **Gooseberry**. Tree found in the forests as well as in the low country. Fruits highly medicinal

and used in several ayurvedic preparations. Fermented liquor prepared from the fruit used in jaundice and cough. Seeds used for asthma, bronchitis and biliousness. *Philanthus niruri* (Keezhanelli). A small perennial herb found in waste lands and on roadsides. Juice of root and leaves mixed with milk given for jaundice. Powdered leaves and roots pulverized and made into poultice with rice gruel used to lessen oedomatous swellings and ulcers. *Antidesma zeylamicum* (Thali). A small tree found in evergreen forests at low elevations. Leaves used in treatment of snake bite. *A. bunius* (neela thali). A small evergreen tree found in moist forests of Ranni, Peerumedu etc. upto 1500 metres. A. disndrum (Areepazham) A small tree found in low country and in the evergreen forests. *Sauropus androgynus* (Singapore Keera) A shrub often cultivated for its edible leaves or run wild seen in country fences. *Glochidion zeylanicum* (Neervetti). A small tree of the mangrove forests. *G. tomentosum* (Nellikkapuli). A small tree found in grass lands. *Aporosa lindleyana* (Vetti). An evergreen tree with coreaceous leaves, found in the hills in evergreen forests. Decoction of leaves given in jaundice, fever, head-ache, seminal loss and insanity. *Croton malabaricus*. A medium sized tree found in W. ghats in evergreen forests at about 1000 metres above sea level. *C. tiglium* (Neervalam Nanchu). A medium sized tree. Seeds and oil a severe drastic purgative Used as fish poison and in snake-bite.*Mallotus occidentalis* (Vattakumbil). A moderately sized tree found in Western Ghats. *M. Philippinensis* (Manjana, Tavitu). A small tree, much branching low down. Found in the Western Ghats in the evergreen forests and scrub jungles. *M. beddomi*. A shrub with large leaves found in the hills upto 1500 metres above sea level. *Macaranga indica* (Vattathamara). A quick growing tree often found in low lands as well as in the foot of hills. *Micrococca merculialis* (Poocha mayakki). An annual herb found in most plains in low country as well as in the foot of the forests. *Acalupha indica* (Kuppameni). An erect annual herb in all plains and in the lower hills. Also found as weeds in gardens, road sides and in cultivated lands. Leaves have laxative properties and mixed with garlic, they are anthelmintic and mixed with salt applied to scabies. *A. fruticosa* (Chinni). A strong-smelling shrub found in dry regions. Leaves valued as a stomachic in dyspeptic affections and in cholera. *Tragia*

Involucrata (Koduthoova, Valli choriyanum). A herb with stinging hairs found in waste lands. Root given in fever, and for pains in the legs and arms. Fruit rubbed over the head with a little water useful in preventing baldness. *Homonoia riparia* (Kalloor vanchi). An evergreen shrub found in the beds of rivers and steams. Decoction of roots used in piles, stone in bladder, gonorrohea and syphilis. Root given for ulcers and urinary discharges. *Ricinus communis* (Avanakku). Cultivated and found run wild in the fields and gardens in the roadsides and wastelands. Decoction of roots with butter is a good laxative.

Oil from the seed used in medicine, as a purgative. Leaves applied to head to relieve head-ache and as poultice for boils. *Jatropha gossypifolia* (Chuvanna kadalavanakku). A small dark-coloured shrub with reddish flowers. Found in all plains on road sides and waste places. Leaves applied to boils, eczema and itches. A native of Brazil, but naturalised in many parts of Kerala. *J. curcas* (Kadalavanakku). A shrub with yellowish green flowers, cultivated as fencing material. Seeds acts as aero-narcotic poison. Sticks used as tooth-brushes for strengthening of gums. Juice of plant useful in scabies, eczema and ring worm. *J. mullifida, J. Pandurifolia* and *J. podagrica* are some of the other species cultivated in the gardens. *Excoecaria agalloca* (Komatti). An evergreen tree with poisonous milky juice which can blind the eyes, on contact. Juice boiled in oil applied in rheumatism, leprosy and paralysis. *Manihot esculenta* (Maracheeni, Kappa Marakkizhangu). The tapioca plant of commerce. Root tubers form common man's food in Kerala. Exotic plant, but cultivated extensively in Kerala. *Hevea braziliensis*. The Rubber tree. Extensively cultivated in Kerala for its latex, the source of Rubber.

ULMACEAE

Ulmus integrifolia (Aval). A large deciduous tree seen in the low lands of Kerala, especially in the Western Ghats. Bark whitish grey with an offensive smell. Wood mederately hard and used as firewood. *Cellis trinervia* (Bhutha). It is a small forest tree at low elevation. Wood dull white with a small dark core having a disgusting smell. *Gironniera recticulata* (Kodithanni). A very large timber tree with buttressed base.

mixed with lemon juice used internally as a blood purifier in itch and other extraneous erruptions. *Trema orientalis* (Amathali). Known as charcoal tree. A small rapid growing tree very common in low country as well as in the forests. Wood light reddish-grey, and soft Excellent for gun-powder charcoal. Often grown as a shade tree.

CANNABINACEAE

Cannakis sativa (Kanchavu, Ganja). A large aromatic resinous herb. It is grown as a source of the drugs ganja, bhang, and marijuana . Only licence holders are allowed to grow these plants. Wherever it is grown, it is the property of the State. The plant is used as tonic, intoxicant, narcotic and sedative.

MORACEAE

Strebles asper (Paruva). A small evergreen tree with usually small, wedge-shaped leaves. Wood moderately hard, touch and elastic. The rough leaves are used to polish ivory and wood. Decoction of bark given in fever, dysentery and diarrhoea. Root used as application to unhealthy ulcers and sinuses. Milky juice antiseptic, astringent. *Ficus tomentosa* (kallal). A tree throwing out small aerial roots from the branches. Often epiphytic. F. *bengalensis* (Peral). Common in decidous and semi-evergreen forests. It is often cultivated as a shade on the road sides. It throws out roots to support the horizontal branches. The milky juice of the plant applied externally for pains in rheumatism and lumbago. *F. retusa* (Ittyyal). A large evergreen tree with few aerial roots seen at elevations of about 1500 metres above sea level. Often it is epiphytic. Wood light reddish-grey, moderately hard. This is considered to be one of the best of fig woods. F. *religiosa* (Arayal, Arasu). Widely planted in temple compounds and as avenue trees. Bark, leaves, fruits, seeds and young shoots are used in Ayuevedic preparations. F.recemosa (Athi). A large deciduous tree in the evergreen forests. Wood greyish brown and soft. Bark given to cattle suffering from rinder-pest. Sap of root used for treatment in diabetes. *F. hispida* (Erumanakku). *F. gibbosa* (Ithi). *F. asperima*

(Therakam). *F. tslela* (Koyall) and *F. travancorica* are some of the other species found grown in this part of the country.

URTICACEAE

Laportia terminalia (Choriyanam). An undershrub found in evergreen forests. *L. crenulata* (Ana choriyanam). A stout shrub or a small tree. The fibre from this tree is very strong and made into strong cordage. The sting of the hair is very painful lasting for hours, particularly during flowering season. *Pilea wightii*. A flaccid herb in evergreen forests. *P. trinervia* & *P. microphylla* are the other species mostly found in this State. *Pellionia heyneana, Droguetia diffusa, Boehmeria malabarica, Villebrumea integrifolia,* & *Debregeasia velutina* (Kattunochi) are the common plants belonging to this family found growing in this part of the country.

CASUARINACEAE

Casuarina equisetifolia (Katadi, chavoke, choola maram). A tree usually cultivated in gardens. Wood valued as fuel.

SALICACEAE

Salix tetrasperma (Vanji). A fairly large tree of the forests. Wood used for gun-powder charcoal The twigs are woven into baskets.

CERATOPHILIACEAE

Ceratophyllum missionis. This is a fragile algae like herb common in paddy fields.

Monocotyledons

HYDROCHARITACEAE

Hydrilla verticillata. A slender submerged weed, very

common in unused ponds and ditches throughout Kerala. *Vallisuaria spirallis, V. Octandra, Blyxa echimosperma, Ottelia allamoides, & Halophyla ovata are some of the other aquatic plants of this family found growing in this State.*

BURMANNIACEAE

Burmannia candida is a slender herb usually found in moist places. Common in Western Ghats from sea level to 2000 metres above sea level.

ORCHIDACEAE

Oberonia denticulata found in Western Ghats. Tufted epiphytes. Leaves distichous flowers dull orange coloured. *O. verticillata, O. recurva, & O. wightiana* are the common species of the genus found in high attitudes.
species of the genus found in high attitudes. *Microstylis wallichii* flowers in purple or yellowish colour. *M. versicolour.* A terrestrial orchid. Flowers greenish yellow or purple. *M. densiflora.* Root bulbous. Seen only in high elevations. *Lipperia wightiana.* Small. delicate. delicate.

pseudo bulbous terrestrial herbs.*L. Walkeriae, L. pusilla* and *L. langipes* are the common species of this genus found in Kerala. *Dendrobium fimbriatum.* White or purple flowers with red patches. *D. humile.* A small epiphyte. Sepals and Petals white. *D. hayneanum, D. graminifolium, D. ovatum, D. barbatulam, D. herbaceum, D. nutans, d. microstachys, D. haemoglossum d. hetrocarpum* and *D. album* are the species found in Kerala. *Bulbophyllum albidum.* Flowers cream-coloured. *B. fuscopurporium.* Flowers dark purple. *B. neilgherrense.* Flowers brownish yellow or greenish purple. *Cirrhopetalum aereum.* Eliphytic, one—leaved pseudobulbs from a usually creeping rhizome. Flowers golden yellow. *C. acutiflorum. Flowers* Flowers greenish white or creamcoloured. *Eria reticosa.* Epiphytic herbs, pseudo bulbous. Flowers white, tip edged with purple. *E. axilis, E. albiflora* and *E. dulcelli* are the other species found in Kerala. *Pachystoma Senile* Terrestrial herb with nodose rhizome. Generally found at elevations between

1000 to 2000 metres. Solitary leaf. Flowers white, green, or pink with bracts longer than flowers. *Josephia lanceolata* stemless tufted epiphytic herbs with root fibres and radical correaceous leaves. Flowers on panicled spikes. *Coelogyne nervosa*. Epiphytic herbs. Flowers white with yellowish lip. *C glandulosa*. Flowers white with white and yellowish brown lip. *Philiodota imbricata*. A pendant herb with aggregatd pseudo bulbs narrowly ovate cylindric. Leaf solitary. Drooping flowers *abut 70 cms*. long. Flowers white with pink or yellowish brown tinge. *Calanthe masuca* Terrestrial herbs often pseudo bulbous with a stout pseudo bulbous leafy stem. Flowers pale or dark purple. Often cultivated as a garden plant. *Arundina bamboosifolia*. Terrestrial erect plants found at elevations between 1000—2000 metres. A stout woody reed like plant reaching a height of 15 cm. Flowers pinkish purple. *Eulophia graminae*. Glabrous terrestrial herbs. Flowers green with white tip. *E. pratensis, E. nuda, E. cullenii* are the other species found *in Kerala*, *Cymbidium aloifolium*. 'An epiphytic orchid with pseudo bulbs. Flowers yellowish red or brownish red. *Geodorum densiflorum*. A stout terrestrial herb with tuberous root stock. Racene upto 30 cms. long. Flowers pale purple or rose. *Luisia teretifolia*. Tufted epiphytic herb with fleshy elongate leaves. Flowers greenish yellow or pale pink. *Kingiella decumbens*. A small pendulous herb. Stem stout. Leaves oblong. Flowers pale purple. *Rhynchostylis retusa*. Flowers pale pink spotted with darker pink. Found in the Malabar coast. *Chilochista pusilla* small epiphytic herbs. Stem very short, leafless, scaly. Roots green, slender. Flowers white or creamy. *Aerides cylindricus*. Epiphytic herbs. Stem leafy. Flowers white or tinged with red. *A. maculosum, a. ringens & A. Odorata* are the other species found in Kerala. *Vanda parviflora*. Epiphytic herb. Very common throughout the State. Flowers yellow. *V. Spathulata* and *V. tesselata* are also found in our forests. *Succolobium filiforma* Epiphytic. Stem leafy. Flowers rose or orange yellow. *S. Jerdomianum* and *S. pulchellum* are the other species found in Kerala. *A campe wightiana*. Epiphytic herb with long stout stem. Flowers yellow with red tinge. *A. congeota* with white flowers tinged with yellow and purple are also found. *Vanilla planifolia*. A climber with fleshy leaves. The poles yield vanilla, a perfume

for flavouring confectionery. *Anoeohtochilus elator*. Terrestrial leafy herbs. Leaves often coloured. Spikes erect. Leaves velvety green with golden nerves. Flowers pink. *Odontochilus rotundifolius* found in evergreen forests. Stem, nodose, hairy with hairs from bulbous base. Flowers solitary.*Nervilia plicata* Terrestrial tuberous one leaved herbs. Leaves appearing after the flowers. *N. biflera, N. carinata* and *N. aragoana* are the other species found in Kerala. *Habinaria barbata* Terrestrial. erect unbranched herb. Flowers white. *H. barbata, H. digitata, H. raciflora, H. heyneana, H. marginata*, and *H. diphylla* are the other common species found at 2000 metres above sea level. Terrestrial herbs with succulent root fibres. Leaves radical. Flowers solitary, yellowish green streaked and blotched with reddish purple.

ZINGIBERACEAE

Globba ophioglossa. Erect herbs. Generally found in moist localities, at elevations between 700—1500 metres. Flowers deep yellow. *Curcuma zeodaria* (Kachuri kizhangu) stemless herbs usually cultivated. Rootstock tuberous. Decoction along with pepper, cinnamon and honey beneficial for relieving cold. *C. aromatica* (kasthoori manjal) wild turmeric. Externally applied in combination with astringents, bitters and aromatics to bruises and sprains and to induce eruptions. Also considered as an anti—venom for snake bite. *C. amada* (Manga inchi) cultivated. Rhizome applied over sprains. *C. longa* (Manjal). The turmeric plant cultivated. *Kalmpferia galanga* (katcholam). Found at low elevations. Flowers fragrant. Tubers powdered and mixed with honey given to cough and pectoral affections. *K. rotunda*. Root applied to reduce swellings in form of a poultice used to promote suppration. Plant powdered used in the form of an ointment efficacious in healing fresh wounds. *Hedychium coronarium* known as ginger lily or torch flower. Generally cultivated as a garden plant. *Zingiber officinale* (Inchi) cultivated. Often grown in places in the western ghats. The dried ginger is known as *chukku*. The raw and the dried ones are used medicinally and as a spice. Prescribed as an adjunct to many tonic and stimulating remedies.*Z. zerumbat* (kattinji)

found at an elevation of abut 1000 metres. Flowers pale sulphur yellow. ***Z. casumunnar*** found in the Western Ghats. ***Costus speciosus*** (Ana koova, kottam) found at elevations below 1000 metres, and in moist localities. Stem spirally twisted. Flowers white in very dense spikes. ***Elettaria cardamomum*** (Elam). Many wild varieties of cardamom plants are found in the forests. Mostly cultivated for the fruit. Perennial herbs with thick horizontal root stock. Seeds used as condiments and in medicines. ***Alpinia galanga*** (chittaratha). Perennial herbs. Rootstock horizontal. Leafy stem tall. Flowers greenish white. Used in several Ayurvedic preparatins.***A. calcarata*** is also found in the forests.

MARANTACEAE

Maranta arundinaceae (koova). Arrow root plant. Many cultivated for the edible root tubers.

CANNACEAE

Canna orientalis (c. indica). Many varieties of this garden plant are cultivated. The rhizome of some wild varieties are edible.

MUSACEAE

Musa superba (kattuvazha) Common on the rocky hill sides in the western ghats. ***M. paradisica*** (vazha) cultivated plantain in our country. ***Ravenala madagascarensis***. This garden plant is commonly known as traveller's palm.

BROMELIACEAE

Ananes sativa (Prithi chakka, kadachakka). Pine apple plant. Though not indigenous, often cultivated for its fruit.

HAEMODORACEAE

Peliasanthes nellegherrensis. Found at Munnar at elevations between 1000 and 2000 metres above sea level. Perennial herbs with short tuberous rootstock. Flowers greenish to dark purple. *Ophiopogon intermedius*. Found in Western Ghats at an elevation between 1500 and 2500 metres above sea level. Flowers white.

IRIDACEAE

Belemcanda chinensis (Neerutti kizhengu). The red wild onion. The bulb is highly medicinal. It is an important drug in Chinese Materia medica and chief remedy for tonsillitis and given in chest and liver complaints and an ingredient in tonics.

AMARILLIDACEAE

Curculigo orchioides (Nilampana). A short plant with golden yellow flowers. Rhizome prescribed in piles, jaundice, asthma, diarrhoea, etc. Used as poultice for itch and skin diseases. *Crinum asiaticum* (Vishamanjal). Stout herb. Rootstock bulbous. Flowers white. Bulk used in billiousness and in urinary troubles. Leaves applied to skin diseases.

DIASCOREACEAE

Disacoreas are climbers or shrubs with tuberous rootstock or with a hard rhizome and tuberous roots. *Diascorea esculenta* (Nanakizhangu, cherukizhangu or Mullu kizhangu) cultivated for its edible root tubers. *D. bulbifera* (Vithu kachil) wild as well as cultivated. Bulbous large and edible. *D. hispida, d. tomentosa, d. pentaphylla, d. spicata, d. wallichi, d. alata* are the other common species of this genus found in Kerala

LILIACEAE

Asparagus racemosus (Sathaveri). Twining undershrubs. Root stock stout, creeping, bearing tubers. Leaves reduced to minute spines which bear in their axils tufts of more or less

leaf—like cladodes. Root medicinal. Bark of root poisonous. *Smilax aspera* climbing shrub, often prickly. Short petioles generally bearing tendril on either side about the base. Inflorescence umbellate. Root used medicinally and is a substitute for Indian sarsaparilla. *S. zeylamica* (karivilanchi). Found throughout Western Ghats at about 1500 metres above sea level. *Gloriosa superba* (Menthonni) climbing herbs. Leaf tip develops into tendrils. Flowers large, yellow, orange or red in colour. *Sansevieria zeylanica* stout fleshy herbs, with creeping rhizome. Cultivated as an ornamental plant in gardens. *Aloe vera* (Kattarvazha). Dwarf succulent plants. Flowers in racemes, dull red in colour. Cultivated as a garden plant and for its medicinal use. *Chlorophytum heynii*. Perennial herbs with fleshy and tuber like roots. Flowers racemose on simple or branched scapes. Found in the Western Ghats. *C. malabaricum, C. attenuatum, C. orchidastrum* and *C. laxum* are the other common species found. *Allium cepa* (ulli). The onion plant. Inflorescence a cymose umbel. Bulbs are stimulant, diuretic, aprodisiac, expectorant, and useful for dysentery. Used in curries. *A Sativum* (Vellulli). The garlic plant. Juice of garlic is used in skin diseases and as ear—drop for ear diseases. Also used as a remedy for gas trouble.

PONTEDERIACEAE

Eichornia crassipes (Kula vazha). The water hyacinth. An american plant introduced into our country, and has became a menace. Recent studies show that it is good for water purification.

COMMELINACEAE

Zebrina peudula. An exotic plant often cultivated in gardens. *Commelina nudiflora* (Vazhapazhathi). Slender creeping herbs. Crushed plants pplied to burns, itches and boils. Leaves used for poulticing sores. *C. benghalensis*. Found in moist regions. Plant beneficial in leprosy.

PALMACEAE

Bentickia coddapanna (kantha kamuku). The hill arecanut.

Stem smooth, grey, attaining about 20 metres. Leaves in whorls. Terminal bud is edible. *Pinanga dicksonii* (Kanakamuku). Stem smooth green, attaining a height of 10 metres and a diameter of 8 cm. Fruit used as a substitute for betel nut. *Cocos nucifera* (Thongu). Most common tree of Kerala. *Calamus thwaitesii* (Valiya chooral). Found growing along the west coast at low elevations. *C. travancoricus* (cheruchural). A graceful slender climber. Found at western ghats.

PANDANACEAE

Pandanus tinctorius (kaitha). A branched shrub upto 8 metres high. The leaves are used for making mats and umbrella. Fibres used for cordage and fishing lines.

TYPHACEAE

Typha angustata. Commonly known as rheed mace or bull-rush. A robust plant upto 3 metres, occurring in marshes. Leaves upto 3 metres long. Found in all districts from sea level to 750 metres.

ARACEAE

Pistia stratioides (Muttapayal). Common in tanks and wells in all districts. A small floating stoloniferous herb. *Lagenandra toxicaria* (karimpola). Marsh herbs. Rootstock creeping. Spathe greenish purple outside, dark purple within. Found throughout west coast in marshes and along water courses, from sea level to 1500 metres. *Acorus calamus* (vayambu). Aromatic marsh herb. Root stock creeping., Often cultivated. Roots used medicinally and also to protect clothing from insect damage. *Colocasia antiquorum* (chembu). Tall coarse herbs. Tubers upto 15 cm. diam. Found in all districts, wild or cultivated. *Alocasia indica*. Widely cultivated. Spathe yellowish green with offensive smell. Tuber used as medicine in piles and constipation.

Remusatia vivipara Tuberous herbs emitting leafless bulbiferous shoots from the sides of the tuber. Found in all districts, upto 2000 metres above sea level, in clefts, on tree trunks or in

pockets of soil in bare rocks. .Root made into an ointment with turmeric used as remedy for itch. ***Amosphophalus campanulatus*** (Mullan chena). Cultivated in all districts for its edible tubers. **A. dubius** (chena). Commonly cultivated. ***Rhaphidophora lacimiata*** (Anattippali). Found in hilly tracts in evergreen or moist deciduous forests upto 1000 metres above sea level. Leaves occasionally perforated with ellipatic holes. Juice of plant used in snake-bit and scorpion sting. ***Pothos scandans.*** Evergreen shrubs branching adventitious aerial roots. Leaves simple distichous. Found in regions upto 750 metres above sea level.

LEMNACEAE

Lemna pancicostala (Tharavu). Small or minute scale-like green floating herbs. stemless. rootless or with capillary rootlets from the margins or the lower surface. Found in still waters in most localities commonly known as duck-weed. ***L. gibbe,*** and ***L. polyrrhiza*** are the other species found in Kerala. ***Wolffia arrhiza.*** Very minute sub globose and rootless. Found in still waters in all districts.

ALISMACEAE

Alisma oligococcum. Floating herbs, commonly grown in Quilon and kottayam districts. White flowers in umbelled or panicled whorls. ***Limnophyton obtusifolium.*** Erect succulent marsh herbs. Leaves reniform. Found in all districts from sea level to 2000 metres.

APONOGETONACEAE

Aponogeton natans. Aquatic herbs with floating leaves. Rhizomas tuberous. Found in all districts of Kerala from sea level to 1500 metres.

POTOMOGETONACEAE

Potomogeton Indicus. Submerged aquatic plants with floating leaves. Rhizomes creeping. Found in all districts of Kerala from sea level to 2500 metres. ***P. javanicus*** leaves filiform with distinct petaole. Found in backwaters of Kerala.

NAJADACEAE

Najas indica. Slender submerged freshwater herbs. Stems rooting from the nodes. Usually found in the southern Kerala.

ERIOCAULACEAE

Eriocaulon cuspidatum. Annual or perennial herbs found in marshy places. Stem very short or absent. Flowers minute, densely packed in a solitary discoid head. *E. stellulatam, E. robustum, E. robustobrownianum*, and *E. elenorae* are the other common species found in Kerala.

CYPERACEAE

Killinga triceps (Muthanga kizhangu). Grass-like perennial herbs. Found in dry parts of Kerala. Used in indigenous *Cyperous cephalotus* (koran pullu). Annual or perennial herbs. Leaves usually radical, flat or terete and channelled. Inflorescence in simple or compound umbels. A number of species of this genus is found in Kerala. Most of them are used for mat weaving. *Eliocharis capitata*. Herbs with stout rhizomes. Leaves reduced to sheaths embracing the base of the stem. Found in rice fields and moist sandy localities. *Fimbristylis tetragona*. Herbs usually erect with a stout rhizome. Stems usually tufted. Leaves narrow from near the base of the stem. *F. dichotoma, F. ferruginea* and *F. arnottiana* are the other common species found in Kerala. *Rynchospora wallichiana*. Erect herbs with grass-like leaves. Found in backwaters.

GRAMINAE

Coix lacryma—jobi (kattu konthamani). Known as Job's tears. Annual or perennial tall erect plants. Leaves flat. Found in all districts except in the hottest and driest localities. Cultivated by the hill tribes for the grains. Leaves form a good fodder. *Polytoca barbata*. Annual or perennial erect herbs. Leaves narrow and flat. *Spinifex sqarossus* (Ravanan meesa). Gregarious much branched woody shrub. Leaves rigid with spines at the tip. A very useful sand binder found in sea sands in the coastal districts. *Saccharam officinarum* (karimbu)

—sugarcane Erect perennial tall shrub. Culms usually solid. Leaves narrow and flat. Extensively cultivated especially in Alleppey and Kottayam districts. *S. spontaneum* and *S. arundinaceum* (Naikana, Naikarimbu) are the other species found in Kerala. *Ischaemum timorense*. Usually perennial . Leaves convolute when young, eventually flat. *I. thomsonianum, I. semi sagitatum, I. rongacharianum*, and *I. travacorense* are the common species belonging to the genus found in Kerala. *Vetiveria zinzanoides* (Ramacham). Coarse perennial herb with stout rhizomes. Leaves narrow. A good fodder in the early stages. The aromatic roots are used for making the well known khaskhas mats for cooling dwellings and for fans. An aromatic and medicinal oil is extracted from the roots. *Sorghum volgare* (cholam). There are a number of cultivated species of this cereal found in India. The plants are of great economic importance for the grains and as a fodder, hay and thatch grasses. **Heteropogon contortus** (Pani pullu). Commonly known as spear grass. Annual or perennial, usually branched herbs. Found in all districts from sea level to 2500 metres. A very troublesome grass owing to the sharp, barbed callus and the hygroscopic owns which cause the fruit to adhere to and penetrate the clothing of man and hairs of animals. *H. oliganthus* is also found in Kerala. *Sachizacharium brevifolium*. Annual perennial herbs with narrow leaves. *Cymbopogon nardus. Aromatic perennial herbs. Leaves flat. Frequently cultivated for its aromatic* oil. Popularly known as citronella grass. **C. citratus** (vasana pullu) known as lemon grass. Cultivated for aromatic oil. *C. flexuosus* (chukkunaripullu). It is also cultivated for its oil known as *Malabar lemon grass oil*. *Panicum nodosum*. Annual or perennial woody herbs. Found at elevations upto 2000 metres above sea level. **P. prostratum** (shani pullu), *P.* humilis, *P.* miliaceum, *P.* miliare (chama) *P.* maximum (ginipullu) and *P.* repens (Inchipullu) are the common cultivted and wild grazing species found in Kerala. **Setaria italica** (Thina). Widely cultivated for the grains. *Pennysetum* (typhoideum kambu). Cultivated in many places for its edible grain and for fodder. Commonly known as pearly millet. *Arundinella holocides* (Mulampullu). Found growing throughout the State at the elevations ranging from 500 to 2000 metres. *Parotis indica* (Kuthira val pullu). Common in all districts both on sea sands

and usually in dry soils. *Cynodon dactylon* (Karuvappullu). Common doob grass. Perinnial creeping grass. *Eleusine coracana* (Koovaragu, ragi) cultivated in and hilly parts of most districts. The grain is an important article of food. The culms and leaves are good cattle fodder. *Oriza sativa* (Nellu). The paddy plant. Cultivated in all districts in wet fields for its edible grain and straw. *Leersia hexandra* (Nirvallu pullu). Found in marshes and lakes of most places. Cattle fodder. *Hygrorhiza aristata* (valli pullu). Glabrous floating herbs. Culms about 30 cm. long. Found in all districts upto 1000 metres above sea level. *Arundinaria densifolia*. Erect or climbing woody shrubs. Common in Anamudy at an elevation of 3000 metres. *Dendrocalamus strictus* (Kallan mula). The throny bamboo. *Teinostachym beddomei* (chittu mula) shrubs of trees. Culms rather slender, drooping above. About 7 metres high and 3 cm. in diameter. *Oxytenanthera monodelpha*. Reed-like erect trees. *Ochlandra scriptoria* (ottal). Reed-like woody shrubs or trees. Culms erect. Found growing as thick clumps on river banks. *C. beddomii, C. travancorica* and *C. wightii* are the other species found in Kerala.

Gymnosperms

Cycasaceae

Cycas circinalis (Kana, Kalanga, Intha). A small evergreeen palm-like tree common in forests. Often seen in villages of Central Kerala. Grown as an ornamental tree in gardens.

PODACARPACEAE

Podocarpus latifolia (Narambali). A tall tree with a cylindrical stem and thin glabrous leaves. Found in our forests at elevations above 1000 metres.

GNETACEAE

Gnetum scanswna (Oadal). A large woody climber seen all over in Kerala forests. *G. gnemone*. This woody climber is common in small bushy forests in Quilon, and Kottayam Districts.

ALGAE

This simple group of plants belonging to the Flora of Kerala exhibit an almost endless variety of structural and morphological pecularities and adaptations to different living conditions. They are known according to their colour.

CYANOPHYCEAE (Blue green algae)

Nostoc. Jelly like forms often found on moist soil, stagnant waters, terrace of buildings etc. *Oscillatoria*. A number of species of this genus is quite common in paddy fields and other watery areas. The filamentous thallus is slimy in texture. *Gloeocaspa* species of this colonial jelly-like form is often seen on damp chunam walls. *Anabaena* several species of this genus with filamentous thallus are often seen in paddy fields. Rivularia of the many species some are terrestrial while others are aquatic. Often found in paddy fields. *Scytonema*. *Many* species occur in fresh and salt waters or in terrestrial and aerial habitats. They are filamentous with mucilagenous sheaths. *Lyngbea* filamentous free floating forms occur in paddy fields.

CHLOROPHYCEAE (Green Algae)

Chlamidomonas. Many species occur in fresh water, some grow in ditches, tanks, ponds, lakes and moist places. Unicellular and motile. *Pandorina* Flat motile colonial form often found during rainy season in ditches, water logging areas and in streams. Endorina Motile colonial forms appear during monsoon in ditches, ponds and water logging paddy fields. *Volvox* found as large globose colony. Motile *Chlorella*. This unicellular green alga is non motile and is found in sewage waters, free trunks etc. It is rich, in protein and hence a promising form for introducing as a nutritive food. Pediastrum. A non motile colonial in paddy fields.

Hydrodictyon. One species of this net-like genus is found in paddy fields, during monsson. *Worthrix* several species of this filamentous form occur attached to moist substratum in all habitats. *Ulva* commonly known as *Sea lettuce*. This ribbon like form is common in rocky coasts of our country. *Enteromorpha*. Some species are marine while others are fresh water. Thallus is long cylindrical tube like. Found in river mouths in outlets to sea. Cladophora. Many species occur in Kerala. Some are fresh water whell others are marine. Marine ones

are found in abundance in rocky coasts. The fresh water forms are attached to rocks or snail shells. *Chaetophora*. Fresh water algae found in shallow waters, pools, lakes etc. Filaments are embedded in gelatin. *Coloechaeta*. Two species viz. C. pulvinata and C. scutata occur in paddy fields, found attached to decaying coconut leaves or other submerged substrata. *Oedogonium*. There are several species found attached to many submerged substrata.*Spirogyra*. Free floating forms. S. *palghatensis* and S. *quilonensis* are the recently reported new species of the genus. *Caulerpa*. Purely marine forms. Many species such as *C. scalpettiformis, C. cupressoides, C. chimmitzia. C. prolifera* are found in the rocky coasts of Kerala. *Vancheria, chara* and *Botrydium* are the other genera of which a few species are found in Kerala waters.

PHAEOPHYCEAE (Brown Algae)

Ecto carpus. Marine brown algae. *Dyctyota* one species of this genus is found at Kovalam *Sargassam* Found in abundance in rocky coasts of Kerala.

RHODOPHYCEAE (Red algae)

Batrachospermum. Purely fresh water. Found in the streams at hill stations like Ponmudi. *Polysiphonia*. It is purely marine.

Fungi

Phytophthora, Pythium, Saprolegnia, Achleva, Saccharomyces, Penicillium, Rhizopus, Mucor, Peziza, Agaricus, Xylaria, Puccinia, Polyporus, Nidularia etc. are the common genera found in Kerala.

Bryophytes

The flora of Kerala is supplemented sparingly by this group of simple thallophytic plants. *Riccia* is the only most frequent Bryophyte appearing immediately after monsoon on laterite soils. It grows only in moist places. *Marchantia, Pellia, Lunularia, Targionia, Porella, Funeria, Polytrichium*, are the other forms

which are less frequent and are confined to moist places at higher elevations.

PTERIDOPHYTES

Ferns are well represented in our flora and are mostly confined to moist areas of Kerala Forests. Some of the important species identified from the State are mentioned below. *Psilotum nudum*. Terrestrial as well as epiphytic. Mostly found in coastal areas. They grow either on bark of coconut trees or on the base of it in humus rich soil. *Lycopodium cernum*. Found in cuttings off hills, slopes etc. *L. hamiltonii, L. microstachya, L. phlegmaria* etc. are the other species found in moist places of forests. *Selafinalla wildenovii* with very long shoots which are sub erect found in hills. *S. kraussiana S. braunii, S. crassipes, S. emmelina, S. gracilis, S. involvens, S. plana, S. radicata, S. ternera, S. vitticosts, S. wallichii, S. spinosa* etc. are the other species recorded in Kerala. *Equisetum debile* found in hilly areas. *Ophioglossum reticulatum*. A very small fern found growing in Trivandrum. *Marattia fraxinia*. A large size fern found sparingly at Ponmudi and Silent valley. *Angiopteris erecta*. A large sized fern found at moist places, in forests. *Osmunda regalis*. This is the Royal fern found on the banks of streams at high elevations and observed in Ponmudi and Silent Valley. *Adiantum candatum* Walking fern found in moist places. Other species of the genus recorded from Kerala are *A. colpodes, A. capilla vereris, A. cuneatum, A. marcophyllum*, and *A. polyphyllum*. *Hemionitis arifolia*. Found on moist walls, hill cuttings etc. *Ceratopteris thalictroides*. Found on swamps. *Aerosticum aureum*. Giant climber found on coastal areas. *Pteris aquilina, P. biaurita, P. dactylina, P. ensiforme* are some of the common species in Kerala forests. *Nepheolepis exaltata, N. cordifolia, N. duffi. N. hirsutula , N. multiflora* etc. are found in moist places. *Blachnum brasiliensis, B. occidentale, B. varians* are found on cuttings of the hills, moist walls, near canals, banks of rivers etc. *Drynaria propinquo* (Plamanjal, Annan potha) often found on tree trunks. Rhizome is a remedy for jaundice. *Microsorium membranaceum. M. pteropus, M. punctatum* are epiphytic on tree trunks found at Ponmudi. *Pleopeltis longissima, P.*

wightiana etc. are also epiphytic on tree trunks, walls, etc. *Trichomanes intramarginata* found on rocks near the banks at Kallar river in Ponmudi. Marsilia quadrifolia *(Nalila thamara)* Found at marshy places. Leaves used in indigenous medicines. *Salvinia auriculata* (African payal). Found in almost all aquatic habitat and a menace to cultivators. *Azolla*. A floating fern in rice fields. *Drymoglossum piloselloides* (Seetha thali). An epiphytic fern on huge trees.

FAUNA OF KERALA

Kerala falls within the Malabar tract of Blandford (comprising of the Western ghats and the Western Coast land from river Tapti to Cape Comorin) which forms a part of the Indian Peninsula. Kerala is a humid Western Ghat country; the diverse terrain of which is broadly divisible into the hills, the plains and the sea board.

The general ecology of the Peninsula "is dominated by its senile topography, physical relation to the Himalayas, the monsoon rainfall pattern and the extensive destruction of natural habitat by man within historical times. The most important factor that dominates both directly and indirectly the entire ecology of the Peninsula is, however, the massive disappearance ofall natural habitats about by deforestation by man" (Mani, 1974). The impoverishment and regression of our fauna is the result of indiscriminate killing and destruction of natural habitat by man (Mukherjee, 1974). A few examples may be cited. The fast disappearance of *Crocidile palustris* (a common Indian Crocodile) and the regression in its range of distribution are the results of massive hunting and extensive destruction of its natural habitat by river taming, irrigation projects, draining of marshes and rapid urbanisation.*Choriotis nigriceps*(the large Indian game bird) which enjoyed a wide distribution extending as far south as Malabar coast and Ceylon is now restricted to Rajasthan, west Punjab and Gujarat. Similarly during the later part of the 19th century *Hemitragus holocripus* (the Nilgiri tahr) occupied a vast area embracing Eastern and Western Ghats. But now its distribution range has shrunk into few pockets mainly due to indiscriminate hunting. *Antelopus cervicapra* (the Black Buck)

and *Tetracerus quadricornis* (the Four-horned antelope) were common throughout the Peninsular region including Kerala are either absent or are vanishing from our forests. Overshooting and shrinkage of the tiger forest have been suggested as the major reaon for the rapid decline of tigers and leopards. The populations of *Macaca silenus* (the Lion-tailed Macaque) and *Presbystis johni* (the Nilgiri Langur) have reduced considerably during the last 50 years. *Hyaena hyaena* (the Striped Hyaena) which was once common in Travancore is said to be extremely rare now (Travancore State Manual, 1940) or probably has disappeared from this area.

As early as 1879 Medicott and Blandford recognised the fundamental similarity of the South Indian fauna to those of Eastern Himalayas, hills of Assam and mountains of North Burma and Malaya, though the present day faunistic distribution shows considerable discontinuity. One of the hypotheses put forward to explain the faunistic similarity is that of Hora's *Satpura Hypothesis* based on the distribution pattern of certain freshwater mountain stream fishes. According to him the Satpura and Vindhya trend of mountains was formerly continuous with Assam hills and the Eastern Himalayas in the east and the Western Ghats in the west. This was assumed to served as a route of dispersal of fauna from the Assam region to the Peninsular India. Salim Ali (1969) states that Ornithology lends support to Satpura Hypothesis. However, Mani (1974) thinks differently. He has derived the Peninsular fauna mainly from two sources. The Peninsular autochthonous elements (derived from the ancient stock of Lemuria and still older Gondwana faunas which were essentially a tropical humid forest one) and the intrusive elements derived mostly from the Asiatic eastern components and the Mediterranean-Ethiopian components. The intrusive elements, according to him, constitute the major components of the present-day fauna of the Peninsula. He adds that the present-day Peninsular fauna has suffered improverishment, regression, evolutionary stagnation, ecological anomalies in distribution and consists of rapidly vanishing relics.

It is undoubtedly a stupendous task to catalogue the fauna of Kerala and the related bibliography. This compilation is

based on a very limited literature that was available some of which are from unpublished theses. It is not claimed by any standards to be an exhaustive compilation, but it is hoped that this would serve as a nebulus for future cataloguing.

The Fauna

Animal Kingdom is divided into two major divisions based on the presence or absence of backbone (notochord or vertebral column). The latter is refered to as Invertebrata and the former as Vertebrata.

Division A : The Invertebrata

(i) Phylum Protozoa

The study of Invertebrates begins with the Protozoa. These are microscopic animals which may be qualified as *acellular* meaning thereby that the body substance of these animals is not partitioned into cells. Some prefer the term *unicellular*. The change in terminology becomes necessary when the fact is recognised that these are not just loose cells moving about, but complete organisms with very complicated construction. These animals may be free living like Euglena, Paramaecium (in soil, fresh-water or marine environment) or may be parasitic like malarial parasite. Informations on the prevalence, distribution and ecological relationships of these animals in Kerala are very meagre and probably the only extensive study is that of the)rder Foraminifera made along the coast of Kerala.

Phylum Protozoa is further sub-divided into five classes. Class Flagellata (Mastigophora) have one to many flagella which are used as locomotor organelles. Euglena is a typical representative of this Class in Kerala. This is a fresh-water organism which when in large numbers give a green colour to the water body. Class Rhizopoda (Sarcodina) have pseudopodia for locomotion and food catching. Amoeba (both free-living and parasitic) are represented in Kerala. The parasitic form causes amoebic dysentery in human beings. One of the well surveyed group under this Class is Forminifera. These are enclosed in simple or chambered shells with one opening or

pierced with numerous pores for the pseudopodia. Survey of Antony (1967) at different depths ranging from 10 to 100 fathoms along Kerala coast revealed the presence of several species of Foraminifera belonging to about 60 genera. The reported genera are : *Rhabdamina; Marsipella; Reophax; Ammodiscus; Ammobaculites; Cyclammina; Textularia; Tritaxia; Gaudryina; Clavulina; Miliammina; Entzia;Trochammina;Quinqueloculina; Massilina; Spiroloculina; Hauerina; Triloculina; Opthalmidium; Sorites; Lenticulina; Dentalina: Nodosaria; Vaginulina; Lagena; Guttulina; Nonion; Nonionella; Elphidium; Operculinella; Operculina; Bulimina; Virgulina; Bolivina; Laxostomum; Uvigerina; Siphogenerina;Trifarina; Reussella; Geminospira; Spirillina; Discorbis; Rotalia; Epistomina; Siphonina; Cancris;Patellinella; Amphistegina; Calcarina; Cymbaloporetta; Cassidulina; Chilostomella; Globigerina; Globigerinoides, Globigerina; Globigerinella; Orbulina; Sphaeroidinella;Globorotalia;Anomalina; Palmerinella; Planulina; Cibicides; Truncatulina; Planorbulina.* According to the survey report *Globigerina bulloides* is the most common and abundant form found between 45 and 100 fathoms all along Kerala coast. The Foraminifera occur in the ocean in such enormous numbers that their empty shells falling to the bottom mud (termed *Gobigerina ooze)* from the prevalence in it of this genus, although other calcareous shells are also present). Calcareous shells consist of calcium carbonate, silica, magnesium sulphate and other minerals. Class Sporozoa are parasitic forms. Typical examples are *Plasmodium* which causes malaria in human beings and *Babesia* causing babesiosis in cattle. Class Ciliata are charaterised by the presence of cilia all over the body. These may be parasitic or free-living. Paramecium is the most familiar example of this Class.

(ii) *Phylum Porifera* (Sponges)

The Porifera or sponges are the lowest of Metazoa or cellular layered animals. Sponges consists essentially of loose aggregation of cells hardly formed into tissues. These have no mouth or digestive tract and their body functions are performed by independent activities of the constituent cells. Nearly all sponges possess an internal skeleton consisting of crystalline bodies called the spicules or of organic fibre or both. Sometimes

foreign particles are also incorporated in the skeleton. The spicules are made of either calcium carbonate or silicic acid. All the sponges are marine with the exception of the family Spongillidae common in ponds and lakes all over the world. These are all sessile in the adult stage. Phylum Porifera is divided into three classes. The survey by Thomas (1968) along Kerala coast shows that at least 27 species belonging to various genera of the Class Demospongiae are prevalent. The account of fresh--water sponges included here relates to informations collected from the Fauna of British India. The various genera described from Kerala are: ***Echinodictyum***; ***Myxilla***; ***Tedania***; ***Clathria***; ***Mycale***; ***Zygomycale***; ***Toxemna***; ***Spirastrella***; ***Laxosuberites***; ***Aaptos***; ***Placospongia***; ***Cliona***; ***Prostylyssa***; ***Tethya***; ***Tethytimea***; ***Spongia***; ***Fasciospongia***; ***Dysidea*** and ***Dendrilla*** are all marine forms mostly collected from 1 to 5 metre depth. ***Spongilla***; ***Pectispongilla*** and ***Ephydatia*** are fresh or brackish--water forms. ***Pectispongilla*** according to Mani (1974) is a Peninsular autochthonous endemic element.

(iii) *Phylum Cnidaria* (Coelenterata)

This phylum begins the study of Metazoa proper which have a definite body form, symmetry, with well developed tissues usually also organs and with a digestive tube opening by a mouth. These have radial symmetry and have epithelial, muscular and connective tissues. This phylum is divided into three Classes: Hydrozoa, Scyphozoa (Scyphomedusae) and Anthozoa. The account of the phylum Cnidaria presented here is based on the survey reports of Krishnan Nair (1946); Mammen (1956) and Rengarajan (1973, 1974). The surveys were made in marine and estuarine waterbodies of Kerala.

Several species belonging to 80 genera under the Class Hydrozoa were described from Kerala. These are. ***Rhizogeton***; ***Turritopsis***; ***Hydractinia***; ***Leuckartiara***; ***Rhizorhagium***; ***Bimeria***; ***Garveia***; ***Coryne***; ***Zanclea***; ***Sphaerocoryne***; ***Lobocoryne***; ***Cladocorynopsis***; ***Halocordyle***; ***Eudendrium***; ***Ectopleura***; ***Hybocodon***; ***Euphysora***; ***Merga***; ***Amphinema***; ***Cytaeis***; ***Bougainvillea***; ***Rathkea***; ***Kollikerina***; ***Niobia***; ***Bythocellata***; ***Proboscidactyla***; **Hebella**; **Hydrodendron**; **Halecium**; **Obelia**; **Clytia**; **Campanularia**;

Orthopyxis; Calamphora; Sertularella; Dynamena; Salacia; Nigellastrum; Pycnotheca; Ventromme; Antennella; Plumularia; Monostaechas; Heteroplon; Macrorhynchia; Gymnangium; Monoserius; Laodicea; Melicertissa; Sataurodiscus; Phialidum; Eutima; Eirene; Helgicirrha; Octocanna; Aequorea; Gonionemus; Olindias; Aglaura; Liriope; Solmaris; solmundella; Cunoctantha; Sulculeolaria; Diphyes; Lensia; Muggiaea; Chelophyes; Eudoxoides; Abylopsis; Bassia; Enneagonum; Amphicaryon; Rasacea; Hippopodius; Vogtia; Agalma; Halistemma and ***Nanomia.***

Class scyphozoa is represented by the genera ***Chiropsalmus; Nausithoe; Pelagia; Cyanea; Aurelia; Netrostoma; Lorifera; Lychnorhiza; Crambionella*** and ***Rhopilema.***

Eudendrium; Cytaeis; Bougainvillea; Plumularia; Obelia; Eirene; Aequorea and ***Aglaura*** are some of the commonest Hydrozoans found along Kerala coast. Crambionella is one of the commonest and largest jellyfish belonging to Scyphozoa found in Kerala waters. ***Netrostoma*** and ***Lychnorhiza*** of Scyphozoa appear in swarms usually during September-November period.

(iv) Phylum Platyhelminthes

The **Platyhelminthes** or Flat-worms are a group of softbodied. bilaterally symmetrical. usually flattened animals. The body is built up from three embryonic layers-ectoderm. mesoderm and endoderm. This phylum includes the notorious parasites like the Liverflukes. Tapeworm etc. This phylum is divided into three Classes: Turbellaria; Trematoda and Cestoda.

Worms belonging to Class Turbellaria are free-living. May be found in fresh. brackish or salt-water. Planaria is a typical example of this Class. Bipalium (worm with axe shaped head) commonly seen in damp soil during rainy season is another example.

Trematodes are parasitic flat-worms. These are further divided into two orders the Monogenea and the Digenea. Worms belonging to the Order Monogenea are all

ectoparasites and are found on the body of the host animal. Survey of Monogenean parasites of marine fishes of Kerala coast by Tripathi (1954 1959), Ramalingam (1952 1964), Unnithan (1957 1966) and Sivasankara Pillai (1960 1970) has enriched our information on this group considerably. Several species belonging to abut 65 genera have been described. All these have been recovered from the gills of marine fishes, except probably one which was recovered from the tongue of a fish. The described genera are *Ancyrocephalus; Diplectanotrema; Haematopeduncularia; Lobotrema; Murraytrematodies; Protancyrocephalus; Tetrancistrum; Amphibdella; Amphibdelloides; Diplectanum (D. lutiani* parasitic on the gills of *Lutianus malabaricus; D. psammopercis* parasitic on the gills of *Psamoperca waigiensis* and *D. tripathii* parasitic on the gills of *Otolithus argenteus); Lamellodiscus (L. japonicus* parasitic on the gills of *Nemipterus japonicus); Tetrasoncoides (T. trachinocephali* parasitic on gills of *Trachinocephalus myops); Neocalceostoma; Dionchus; Loimos; Horricauda (H. djiddensis* parasitic on gills of *Rhynchobatus granulatus); Heterocotyle (H. elliptica* parasitic on gills of *Pastinachus sephen); Dionchus; Caballercocotyla (C. chillensis* parasitic on gills of *Pelamys chilensis; C. thazardi* parasitic on gills of *Auxis thazard); Encotyllabe (E. carangis* parasitic on the tongue of *Caranx sp.); Erpocotyle; Mazocraes (M. tradoori* parasitic on gills of *Opisthopterus tradoore); Paramazocraes; Pseudoacanthocotyle (P. anchoviellae* parasitic on gills of *Anchoviella commersonii); Kuhnia; Mazocraeoides (M. sardinellae* parasitic on *Sardinella fimbriata); Neomazocraes (N. commersonii* parasitic on gills of *Anchoviella commersonii); Allodiscocotyla (A. chorinemi* and *A. diacanthi* parasitic on gills of *Chorinemus sanctipetri); Vallisia; Vallisiopsis (V. contorta* parasitic *Sphyraena acutipinnis); Gammaecaputia; Tagia (T. johni* parasitic on gills of *Johnius carutta); Gephyrocotyle (G. ixoracorona* parasitic on gills of *Decapterus russelli); Octoplectanocotyle (O. trichiuri* parasitic on gills of *Trichiurus haumela); Protomicrocotyle (P. carangis* parasitic on gills of *Caranx sansun); Bilaterocotyloides (B. carangis* and *B. madrasensis* parasitic on gills of *Megalaspis cordyla); Microcotyle; Heterapta; Neobivagina; Axine; Axinoides; Monaxine; Bicotyle; Bicotyle; Megamicrocotyle; Kannaphallus; Allopseudaxine; Allopseudaxinoides; Heteromicrocotyle; Gastrocotyle; Pseudaxine; Pseudo-*

chauhanea; Pellonicola; Amphicotyle; Gotocotyla; Pricea; Dawesia; Diclidophora; Osphyobothrus (O. sauridi parasitic on gills of Saurida tumbil); Choricotyle (C. polynemi parasitic on gills of polynemus sexfilis); Neoheterobothrium (N. cynoscioni parasitic on gills of Otolithus argenteus); Dussumericola (D. hasseltit parasitic on gills of Dussumieria hasseltii); Hexastoma (H. affinis parasitic on gills of Euthynnus affinis) and Neohexastoma (N. euthynniparasitic on gills of E. affinis).

Worms belonging to Order Digenea are all endoparasitic on vertebrates including cattle and human during their adult stages. Their larval stages are spent in invertebrate intermediate hosts, such as mollusca. An account of the various species collected and reported from Kerala along with their host records is given below

Bucephalus varicus off alimentary canal of Caranx sexfasciatus and Sphyraena jello; Trichobilharzia rodhaini from duch Bivitellobilharzia nairi from elephant; Schistosoma nairi from elephant. S. nasale from cattle and buffalo. Pfenderius papillatus from elephant.Cotylurus orientalis from duck. Cyathocotyle sp. from intestinal tract of duck. Haplorchis taichui from pig. Notocotylus ephemera from intestinal tract of duck. N. attenuatus from intestinal tract of duck. Typhlocoelium indicum; T. cymbium and T. oculeus all from duck. Apharurus longiceps from stomach of Sardinella fimbriata and S. longiceps; Dinurus thunnina from stomach of Thynnus thunnia; Lecithocladium niger off Parastrometeus niger; L. microlepidotus from stomach of Scomber microlepidotus; Lecithochirium magnacetabulum from stomach of Thynnus sp.; L. trichiuri from stomach of Trichiurus savala; Lecithaster fimbriata from stomach of Sardinella fimbriata; Opisthogonus brevirostris from stomach of Triacanthus brevirostris. Podocotyloides orientalis from stomach of Cynoglossus sp. Acanthocolpus liodorous from duodenal region of Chricoentrus dorab; A. thalassinus from intestine of Arius thalassinus; Stephanostomum ruber from intestine of Otolithus rubber; S. dorab from intestine of Chirocentrus dorab. Hypodaerium conoideum, Echinoparyphuim dunni and Echinostoma revolutum from intestinal tract of duck. E. ivaniosi from fowl and Echinochasmus indicus from dog. Fasciola

jacksoni, liver fluke of elephant. *Philophthalmus anatinus* and *P. Peteri* from conjunctival sac of duck; *P. galli* from conjuctival sac of domestic fowl.*Psilochasmus oxyrus* from intestinal tract of duck;*P. oxyrus gallinae* from fowl. *Opisthorchis simulans* and *O. sankunnyi* from liver of duck. *Prosthogonimus cuneatus* from bursa of Fabriceus and uterus of duck; *P. pellucidus* from posterior part of the intestine of fowl. *Haplocladus platycephali* from stomach of *Platycephalus* sp.

The third Class of the Phylum Platyhelminthes is Cestoda. These are all endoparasitic. The adults are found in vertebrates including cattle and human, the larval stages, however, are spent in the intermediate host which is usually an invertebrate. The body of cestodes is ribbon-like with a distinct head or scolex armed with hooks or suckers for anchoring themselves to the tissues of the host. The followng is an account of the cestodes recorded from Kerala.

Phyllobothrium lactucs (Rhinobothrium ceylonicum) from spiral valve of *Dasybatus* sp.; *Echineibothrium tumidulum (Bothriocephalus tumidulus)* from spiral valve of *Dasybatus sp.* E. *Tumidulum* from spiral valve of *Dasylatus walga*; E. *flexile (Rhinebothrium flexile*; E. *Walga*; E. *insignea)* from spiral valve and intestine of *Rhynchobatus djeddensis*; *Cylindrophorus triloculatus (Phoreibothrium triloculatum) from spiral valve of Carcharias melanoptera; Cephalobothrium abruptum* from stomach and spiral valve of *Pteroplatea micrura*; *Tylocephalum uarnak* from spiral valve and intestine of *Dasybatus uarnak.*

Tetrahynchus perideraeus from spiral valve of *Carcharias lacticauda*; T. *herdmani* from spiral valve of *Dasybatus walga*; T. *melanopterus* from intestine and spiral valve *Carcharias melanoptera*; *Tentacularia macrocephala* (=**Tetrarhynchus** *macrocephalus*; T. *ruficollis)* from spiral valve of rats;

Gymnorhynchus malleus from common ray. *Anoplocephala*

manubriate from elephant; *Moniezia expansa* from buffalo and NiligiritahrM. *benedeni* from sheep, goat and cattle; *A. autumnalia* from goat; *Avitellina centripunctata* from ruminants; *Stilesis globipunctata* and *S. Vittata* from ruminants. *Hymenolepsis carioca, H. cantaniana* and *H. exigua* from intestine of fowl. *Cotugnia digonopora, Rallietina tetragona, R. echinobothrida, R. cesticillus, R. macassarensis* and *Davainea proglottina* from the intestine of fowl. *Amoebotaenia sphenoides, A. spinosa, A. trapezoides* and *a. puthurensis* from fowl. *Cysticercus bovis* from ruminants; *C. tenuicolis* from goat and sheep; *Conurus gaigeri* from ruminants; *Echinococcus granulosus* from calf and jackal; *Taenia hydatigena* from small intestine of fog; *T. solium* parasitises human beings. In this case the embryo develops in pigs into what is called a cysticercus (bladderworm). When improperly cooked pork meat is consumed the infective stages enter into the body of human beings and establish in the intestine.

(v) PHYLUM ACANTHOCEPHALA

The Acanthocephala are endoparasitic (parasites within the body of the host) worms of slender cylindrical or slightly flattened form and hollow construction. This is a proboscis at the anterior end which is armed with recurved hooks used for anchoring to the host tissue. Mouth, anus and digestive tubes are absent. The adult worms develop in the digestive tract of various vetebrates and the immature stages are passed in invertebrate hosts especially arthropods such as insects. These worms parasitise fishes, birds and mammals and are found in animals living in marine, fresh-water and terrestrial environments. Twenty-three species belonging to different genera have been recorded from Kerala, the account of which is given below:

Neoechinorhynchus manasbalensis Collected from small intestine of freshwater cat fish *Hteropeneustes fossilis* which is the definitive host. *N. kallarensis* recorded from small intestine of freshwater fishes *Laubuea dadybergori* and *Rasbora rasvora* which are definitive hosts. *Acanthosentis antspinis* recorded from the small intestine of the marine fish *Nematolosa nasus*, which is the definitive host. *Pallisentis nagpurensis*, from small intestine of freshwater fish *Tilapia mossambica* and *Ophiocephalus striatus*, which are definite hosts. *Wallago attu; Ophicephalus*

gachua; Marcropodes cupanaus; Aplocheilus melastigma (liver is found infected in all these) ***Heteropeneustesfossilis*** and ***Rana tigrina*** (mesentery is infected in these) are all paratenic hosts. ***Cyclops strennus*** is the intermediate host. ***Raosentis invaniosi***, recorded from small intestine of freshwater fish Arius platystomus which is the definitive host ***Filisoma indicum*** from the small intestine of the freshwater fish ***Scatophagus argus*** which is the definitive host.***Echinorhynchus truttae*** from small intestine of the marine fish ***Gerres filamentosus*** which is the definitivehost. ***E. veli*** from the small intestine of the freshwater fish ***Synaptura orientalis*** which is the definitive host. ***Arhythmorhynchus tigrinus*** cysts were collected from mesenteries of ***Rana tigrina*** which acts as a paratenic host and the bird ***Centropus sinensis*** is the definitve host. ***A. ophiocephali*** from freshwater fishes (mesenteries) ***Ohiovrphalus striatus; Arius platystomus, Megalops cyprinoid*** and ***Anabas scandens*** act as paratenic hosts. Piscivorous birds are definitive hosts. ***A. indicus***, cysts collected from mesenteries of the transport host ***Tropidonotus piscator*** (fresh water snake). Carnivorous birds act as definitive hosts. ***Raorhynchus polynemi*** from small intestine of marine fishes ***Caranx gallus, Polynemus heptadactylus*** and ***Johnius coitor*** which are definitive hosts. ***R. schmidti from small intestine of marine*** fishes ***Pseudorhombus triocellatus*** and ***Leiognathus equulus*** which are definitve hosts. Intermediate hosts are marine crustaceans. ***Rhadinorhynchus trivandricus*** from the small intestine of the definitive host ***Arius platystomus*** (freshwater fish). ***Nipporhynchus*** trachuri from the definitive host (small intestine) ***Rastrelliger kanagurta***, a marine fish ***Serrasentis chauhani***, juvenile forms from the mesenteries of marine fishes ***Psettodes erumei, Rastrelliger kanagurta, Caranx kalla*** and ***Platycephalus macracanthus*** (Paratenic hosts). Definitive hosts are large marine fishes. ***S. nadakali*** definitive host of which is a marine fish ***Rachycentron canadus***, the small intestine of which is infected. Encysted juveniles are collected from paratenic hosts (mesenteries) ***Nemipterus japonicus, Johnius axillaris, Pseudirhombus triocellatus,Cynoglossus lingua, Silago sihama*** and .***Pterois miles***, all marine fishes. ***Centrohynchus elongatum*** from the small intestine of the owl ***Athena brama*** (definitive host). ***C. bethaniae*** from small intestine of the bird ***Accipter badius*** which is a definitivehost. Parantenic (transport)

host is the Whipsnake *Dryophis mycterizans* from which cysts have been collected. *Empodisma mariae* from the small intestine of the bird *Acridotheres tristis* (definitive host). *Mediorhynchus channapettae* from the small intestine of the Goldenbacked Woodpecker *Dinopiom bengalense* (definitive host) *Moniliformis moniliformis*, has *Rattus rattus* the house rat the definitive host and the worms are found in the small intestine. Intermediate host is *Periplaneta* americana and juvenile worms are found in the haemocoel of this cockroach. Porrorchis keralensis has the Crowpheasant *Centropus keralensis* has the Crowheasant *Centropus silensis* as definitivehost and the worms are found in the small intestine. Juveniles have been collected from the mesenteries of the paratenic hosts like *Rana tigrina*, *Bufo melanostitus* and *Dryophis mycterizans*.

(vi) PHYLUM ASCHEIMINTHES

This phylum consists of usually small vermiform organisms with cylindroid or flattened body without definitely delimited head. These have digestive tract and respiratory and circulatory systems are absent. Aschelminthes are predominantly aquatic animals, inhabiting both fresh and salt waters, but some nematodes are terrestrial while others are parasitic. This phylum includes free-living, epizoic and parasitic members. The phylum is divided into 6 Classes. Available literature on the occurrence of the members of this phylum in Kerala shows informations only on the Class Nematoda. The other Classes need proper survey in the State. Notorious examples of Class Nematoda are the human filarial worms belonging to the generax Wuchereria and Brugia.

Class : Nematoda

Soil inhabiting nematodes :

Meloiogyne. incognita and *M. javanica*. *Dolichodorus microanulatus*; *Tylenchorhynchus oryzae*; *T. nadus*; *Hirschmanniella oryzae*; *Radopholus similis*; *Hoplolaimus mangiferae*; *Scutellonema curvata*; *Helicotylenchus multicinctus*; *H. crenacauda*; *H. cardamomi*; *H. seshadrii*; *H. acuticaudatus*; *H. indicus*; *H. trivandrunus* and *Rotylenchulus reniformis*. *Criconema*

octangulare; Criconemoides oachiral; C. ornatum; C. siddioti; C. tescorum; Hemicriconemoides brachyurus; H. cocophillus; H. gaddi; H. mangiferae; Caloosia exilis and C. jairajpuri,Dorylaimus aquaticus;, Longidorus saginus; Xiphinema elongatum; X. rivesi and *X. insigne. Axonchium saccatum; A. pseudosaccatum* and *A. elegans. Nygolaimeluus neoabnormis. Clarkus mulveyi; Mylonchulus trivandranus; M. contractus; M. hawaiiensis; Sporonchuloides ibitensis; Iotonchus nayari; I. transkiensis; I. trichurus; I. khani; I. heynsi; I. monhystera; I. kherai; I. prabhooi; I. baqrii; I. indicus* and *I. risoceiae.*

Parasitive nematodes :

Trichuris suis and *Capillaria indicum* are parasites of pig; *C. contorta; C. globocaudata; C. annulata* and *C. Anatus* are parasites of duck *C. caprae* and *Trichuris globosa* from goat. *Strongyloides ransomi* from pig; *S. avium* from duck and *S. papillosus* from goat and sheep.

. *Ascaris summ* from pig; *A. vitulorum* from calves and kids; *Toxocara canis* from dog; *Ascaridia galli* from fowl and *Toxascaris leonina* from lion. *Heterakis gallinae* from fowl.

Enterobious vermicularis infests large intestine and rectum of man.*Cesophagostomum quadrispinulatum* from pig; *O. dentatum* from wild boar, *O. quilona, O. columbianum* and *O. asperum* from goat; *O. radiatum* from calves and kids; *Murshidia indica; M. murshidia, Quilonia travenera, Q. rennie, Amira pileata, Equinurbia siphunculiformis* and *Decruzla aditicta* from elephant. *Stepanurus dentatus* from pig and *Syngamus trachea* from fowl. *Globocephalus connorfili* from pig; *Bunostomum trigonocephalum* from goat; *B. phlebotomum* from calves and kids. *Ancylostoma caninum* and *A. braziliense* from dog. *Gaigeria pachyscelis* from goat; *Grammocephalus varedatus, Bathmostomum sangeri* and *G. clathratus* from elephant; *Ancylostoma duodenale* from dog and man. *Trichostrongylus coluvriformis* from pig, goat, camel and Nilgiri tahr; *T. axei* from goat; *Haemonchus contortus contortous* from goat, sheep and Nilgiri tahr; *Paracooperia matofii* from buffalo. *Metastrongylus salmi* from pig. *Gongylonema ingluvicola* and *Oxyspirura mansoni* from fowl. *Ascarops strongylina; Physocephalus sexalatus* and *Simondsia paradoxa*

from pig; *Echinuria uncinata* and *Tetrameres anatis* from duck; *T. mohtedai* and *T. fissispina* from fowl; *Spirocera lupi* from dog. *Acuria hamulosa* and *A. spiralis* from fowl. *Parobronema indica* and *P. smithi* from elephant. *Indofilaria pattabiramani* and *I. elephantis* from elephant: *Wuchereria bancrofti* and *Brugia malayi* from man; *Dirofilaira immitis* from dog. *Stephanofilaria srivastavai* from elephant.

(vii) *Phylum Anneldia*

These are worms with elongate body, externally and internally segmented with setae or needle like structures present all over the body or localised in appendage like structures extending from the body or absent as a leech. These have complete alimentary canal with mouth and anus. The common earthworm and leech are familiar examples of this phylum. The phylum is divided into three Classes: Archiannelida; Chaetopoda and Hirudinea. Class Chaetopoda is further divided into two orders: Polychaeta (example: Nereis—a marine worm living near sea shore) and Oligochaeta (example: earthworm). In all these cases the body is divided into a number of somites or segments. The following account of annelids is based on publications by Fauvel (1953), Stephanson (1923), Sanjeeva Raj (1976) and Prabhoo (1961, 1964).

CLASS: CHAETOPODA

Order: Polychaeta *Aphrodita australis from 670 fathoms. A. talpa: Iphione muricata; Eunoe pallida* parasitic on echinoderms. *Sthenelais boa and Panthalis oerstedi* off muddy or sandy bottom at 34-810 fathoms. *Paramphinome indica from* 881—891 fathoms. *Choleia fusca. Hesione pantherina* from Ernakulam channel at 9 m. depth. *Tylonereis bogoyawlenskyi* from Neendakara bar and Veli lake. *Dendronereis aestuarina* from Ernakulam channel at 8 m. depth.*Perinereis cavifrons*, common non-tubicolous Polychaete in Cochin harbour area, found creeping on submerged timber. *P. cultrifera var floridana; P. nigre-punctata; P. nuntia var brevicirris; Nereis glandicincta; N. chilkaensis; Pseudonereis anomala. Nephthys oligobranchia*

from Cochin backwaters. *N. dussumieri. Marphysa sanguinea; M. stragulum; M. gravelyi,* a burrowing polychaete, typical brackish water species abundantly found during January—May. Breeds during September—December and is found in all backwaters and estuaries of Kerala. *Diopatra neapolitana,* most predominant species of the bar-mouth region of Cochin harbour at 9 m. depth.*Lumbriconereis pseudobifilaris* and *L. simplex* are burrowing polychaets rare in Cochin harbour area and are usually found at 9 m. depth. *Goniada emerita* and *Glycera alba. Audouinia filigera. Stylarioides bifidus* from 300—555 fathoms. *Asychis disparidentata* from 902 fathoms. *Pectinaria crassa* and *P. abranchiata,* both from Cochin backwaters. *Amphicteis posterobranchiata* from 670 fathoms. *Pista indica* from Ernakulam backwaters. *Ficopomatus macrodon, tubicolous polychaete* from Cochin backwaters.

Order: Oligochaeta. *Nais communis; N.c. caeca; N. pectnata; N.p. inaequalis* and *Pristina longiseta* are small aquatic forms recorded as living in *Spongilla carteri. Achaeta neilseni; A. indica* and *Hemienchytraeus theae* were recorded from moist soil around teabushes. *Achaeta christenseni; A. segmentata. Moniligaster deshayesi; M.d.* var *minor; M.d.* var *gravelyi;* and *M. perrieri* are found in water. *Drawida barwelli* from Vembanad lake. *D. brunnea; D. chalakudiana; D. ghatensis; D. matthaii; D. nilamburensis, D. parambikulamana; D. pellucida* far. *pallida; D. shunkarai; D. travancorensis. Plutellus timidus; Pontodrilus bermudensis; Woodwardia hastata; Comarodrillus gravelyi. Megascolides duodecimalis; M. pilatus; Notoscolex ponmudianus; N. tenmalai; N. t.* var *Karakulamensis; Megascolex cochinensis; M.c.* var *Phaseolus; M. eunephrus; M. filiciseta; M. insignis; M. kavalaianus; M. Konkanensis; M.k.* var *longus; M. marutii; M. polytheca; M.p.* var *zonatus; M. pumilio; M. ratus; M. travancorensis; M.t.* var *quilonensis: m.t.* var *ghatensis: M.t.* var *bonaccordensis; M. t.* var *pentagonalis M. trivandranus; Pheretima bicincta; P. houlleti; P. travancorensis; P. trivandrana; Octochaetus (Octochaetoides) aikkeni; O.(O) fermori; O.(O)pittnyi; Dichogaster affinis; D. bolaui; D. malayana: D. travancorensis; Gordiodrilus travancorensis; Ocnerodrilus (Ocnerodilus) occidentalis. (Family Lumbricidae') Pontoscolex corethrurus; Glyphidrilus annandelei; Allolobophora (Eisenia) foetida.*

Class: Hirudinea

ORDER: RHYNCHOBDELLIDA *Branchellion plicobranchus* parasitic on fishes *Dasyatis uarnak* and *Carcharias* sp. *Ozobranchus shipleyi* Parasitic on tortoises along backwaters.

ORDER: GNATHOBDEELLIDA *Haemadipsa zeylanica, taken from near sea level to 1100 m.*

(viii) *PHYLUM CHAETOGNATHA*

The chaetognaths (arrow-worms) are slender, elongated animals of relatively small size. The body is like a torpedo and is regionated into head, trunk and tail. These have single caudal and paired lateral fins. Digestive system is present without mouth and anus. These are marine and mostly planktonic (organisms that drift or float almost passively). The account of chaetognaths given here relates to the survey reports of Srinivasan (1969 - 1976) on Kerala coast.

Eukrohnia minuta recorded from deep water plankton hauls of west coast. This is a mesoplanktonic form. *E. fowleri* is a bathyplanktonic form. Sagitta lyra is a mesoplanktonic form. S. *hispida is an epiplanktonic form.* S. *prox. madima* and S. *macrocephala* are bathyplanktonic forms. S. *bedoti*; S. *inflata* and S. *robusta* are spiplanktonic forms the maximum cath of which is during January, February and March. These forms have also been collected from Cochin backwaters. S. *ferox*; S. *hexaptera*; S. *regularis* and S. *pacifica* are epiplanktonic forms. S. *decipiens* is a mesoplanktonic form. S. *pulchra* is an epiplanktonic form collected from Cochin backwaters and is found to reach its maximum catch during May and June *Pterosagitta draco*; *Krohnitta pacifica* and *K. substilis* are epiplanktonic forms. The epiplanktonic forms are seen at the surface and above 200 m. depth of the sea, mesoplanktonic forms are found between 200 and 1000 m. depth and bathyplanktonic forms are found below 1000 m. depth of the sea.

(ix) *PHYLUM ARTHROPODA*

Animals belonging to this phylum have an important advance on the segmented worms dealt with in the previous pages. That

is the possession of a pair of appendages (limbs) with movable joints for each segment of the body. The very name arthropoda denotes the presence of jointed limbs (arthron = joint; podos = foot). This great assemblage embraces animals like prawns, crabs, millipedes, centipedes, cockroaches, butterflies, mosquitoes, scorpions, spiders, ticks, mites etc. These have well adapted to every conceivable niche on earth. They may be free-living (occupying marine, esturine, fresh-water or terrestrial environments) or parasitic (living as ecto and endoparasites). This large and important group of invertebrates are of great economic importance to human society. This phylum is divided into four Classes: Crustacea (Crabs, Shrimps, Barnacles etc.) Myriapoda (Centipedes, Millipede); Insecta (cockroaches, Bettles, Mosquitoes, Butterflies etc.) and Arachnida (Spiders, Scorpions, Mites, Ticks etc.)

CLASS CRUSTACEA

Crustaceans are aquatic arthropods and are further subdivided into 5 major Sub-classes: Branchiopoda (including common fresh-water forms like Dephnia or popularly known as Waterflea); Ostracoda (popularly known as Seed Shrimps including the common fresh-water form Cypris); Copepoda (including free-living Cyclops and several parasitic forms); Cirripedia (the Barnacles) and Malacostaca (Crabs, Prawns, etc.). In this Class parasites are found in Copepoda, Cirripedia and Isopoda which is an Order under the Sub class Malacostraca. Parasitic adaptations include loss of appendages, degeneration of body form and changes in life cycles.

SUB-CLASS COPEPODA:

Survey reports show that several species of free-living copepods belonging to about 50 general have been reported from Kerala. These are *Canthocalanus; Undinula; Eucalanus; Rhincalanus; Paracalanus; Acrocalanus; Calocalanus; Clausocalanus; Euaetideus; Euchaeta; scolecithrix; Centropages; Pseudodiaptomus; Schmackeria; Temora; Pleuromamma; Lucicutia; Heterorhabdus; Holoptilus; Metacalanus Candacia; Labidocera; Pontellopsis; Pontellina; Calanopia; Acartia; Tortanus; Microsetella; Miracia; Clytemnestra; Euterpina; Alteutha; Rhychothalestris;*

Amphiascopsis; Amphiascoides; Diosaccus Oithona; Pontoeciella; Ratania; Hersiliodes; Kelleria: Macrochiron: Pseudanthessius; Oncoea: Lubbockia; Corycaeus; Corissa; Saphirina and *Copelia.*

PARASITIC COPEPODS:

Taeniacanthus indicus is parasitic on the surface of body of *Chiloscyllium indicum. T. narcini* off the gills of *Narcine timlei. T. longicaudus, Parataeniacanthus longicervis* and *Anchistrotos* sauridi were recovered from the branchial chamber of *Saurida tumbil. Parataeniacanthus miles* was taken off the branchial chamber of *Pterois russelli, while Irodes lagocephali was recovered from the buccal cavity of Gastrophysus lunaris* and *Lagocephalus inermis. Parabomolochus megaceros* infests the branchial cavity of *Parastromateus niger. Bomolochus multiceros* and *B. bellones* are found in the inner surface of opercle of *Pesenes indicus* and *Ablennes hians* respectively. *Parabomolochus selaroides* infests branchial cavity of *Selaroides leptolepis. P. hemirhamphi* infests the branchial cavity of *Hemirhamphus marginatus. P. monoceros* inhabits the buccal cavity of *Carangoides malabaricus. Nothobomolochus gibber* from the inner surface of opercle of *Ablennes hians. N. cypseluri* was recovered from the inner surface of opercle of *Cypselurus* sp. *N. trichiuri* is parasitic on *Trichiurus savala*, inhabiting the inner surface of opercle. *N. denticulatus* inhabits the branchial cavity of *Sphyrabena jello. N. multispinous* inhabits the branchial cavities of *Dussumieria acuta* and *D. hassellii. N. kanagurta* inhabits the branchial cavity of *Rastrelliger kanagurta.* Three species belonging to this family found as parasites on the gills of *Psettodes erumei,* and *Pseudorhombus arsius* are *Chondracanthus alatus, C. trilobatus* (both from the former fish) and *Pseudochondracanthus longitruncus,* from the latter fish. *Caligus euthynus* off the surface of the body of *Euthynnus affinis. C. asymmetricus* has *E. affinis* and *E. alliteratus* as hosts. *C. arii* inhabits the buccal cavity of *Pseudarius jattius. C. hamruri* from buccal cavity of *Priacanthus hamrur. C. priacanthi* from buccal cavity of *Lagocephalus inermis. C. clavatus* from buccal cavity of *Sphyraena jello* and *S. obturata. C. auxisi* from branchial

cavity of *Auxisthazard*. *C. cybii* infests the branchial cavities of *Indocybium guttatum, I. lineolatum* and *Cybium commersoni*. *C. indicus* inhabits the branchial cavity of *Trachinotus blochi*. *C. laticaudus is found in the branchial cavities of Polynemus heptadactylus, Rhaodosargus sarha* and *Pagrosomus major*. *C. malabaricus* was recorded from the buccal cavity of *Tylosurus crocodilus*. *C. russellii* from the surface of the body of *Pterois russelli*. *C. amblygenitalis* from the surface of the body of *Euthynnus affinis*. *C. confusus* off branchial and buccal cavities of *Caranx sansum* and *Coryphaena hippurus*. *C. kanagurta off* the branchial cavity of *Rastrelliger kanagurta*. *C. annularis off* the gills of *Otolithus maculatus* and *Caranx sp. C.platurus* off the branchial cavity of *Caranx melanampygus*. *C.dasyaticus off* buccal cavity and surface of the body of *Dasyatis akajeii* and *pristis* sp. *C. longicervicis* off the buccal cavity of *Trichiurus savala*. *C. lepeophtheropsis* off the gills of *Pristis* sp. *C.cornatus* off the buccal cavities of *Sphyraena jello* and *S. obtusata*. *C. tylosuri* off the body of *Tylosurus crocodilus, Chorinemus lysan*. *C. djedabae* off branchial cavity of *Selar kalla*. *C. multispinosus off* branchial cavity of *Pampus argenteus*. *C. constrictus off* the buccal cavities of *Carangoides malabaricus* and *Alectis indica*. *C. acutus* off the body of *Euthynnus affinis* and *Gaterin lineatus*. *C. cordyla* off branchial cavity of *Megalaspis cordyla*. *C. brevicaudus* off branchial cavity of *Caranx sp. C. phipsoni* off branchial cavity of *Polynemus plebeius*. *C. robustus* off branchial cavities of *Caranx sansum* and *C.robustus* off branchial cavities of *Caranx sansum* and *C. melanampygus*. *C. epinepheli* of branchial and buccal cavities of *Chorinemus tala, Drepane punctata, Epinepheles septemfasciatus*, and *E. akara*. *C. chiloscyllii* off the body of *Chiloscyllium indicum*. *C. longicaudus* off the branchial and buccal cavities of *Chirocentrus dorab*. *C. pelagicus*, host of this species is yet to be determined. This species was collected from plankton. *C. rotundigenitalis* off the inner surface was of operculum of *Scatophagus argus*. *C. distortus* off the inner surface of operculum of *Tachysurus* sp. *Pseudocaligus fistulariae* off buccal cavity of *Fistularia villosa*. *Parapetalus orientalis* off gills of *Menemaculata* and *Alectis indica*. *P. hirsutus* off the buccal cavity of *Eleutheronema tetradactylum* and *Polynemus plebeius*.

P. occidentalis off branchial cavity of *Johnius sp.* and *Rachycentron canadus*. *Pseudopetalus formicoides* off buccal cavity of *Sardinella fimbriata*. *P. caudatus* off buccal cavity of *Dussumieria hasseltii*. *P. dussumieri* off branchial cavity of *Dussumieria acuta* and *D. hasseltii*. *Sciaenophilus tenuis* of buccal and branchial cavities of *Johnius* sp. *S. pharaonis* off buccal and branchial cavities of *Johnius* sp. *S. Pharaonis* off the inner surface of opercle of *Otolithus maculatus*. *Caligodes laciniatus* off buccal cavity of *Tylosurus crocodilus*, *T. strongylurus*, *T. leiurus* and *Ablennes hiaus*. Parechetus carangis off throat of *Caranx* sp. and *C. ferdan*. *Synestius caliginus* off buccal cavity of *Parastromateus niger*. *Abasia platyrostris* off*Synodus indicus* and *Saurida thumbil*. *Hermilius pyriventris* off gills of *Arius acutus*, *A. hendeloti*, *Pseudarinus platystomus*, and *Galeichthys feliceps*. *H. longicornis* off gills of *Arius acutirostris* and *A. dussumieri*. *H. helleri* off gills of *Pseudarius jatius*. *H. tachysuri off the gills of Tachysuris* sp. *Lepeophtheirus longipalpus* off *Ariodes dussumieri*, *Pseudarius jatius*, *Arius acutirostris*. In all these cases the parasite was found in the branchial cavity. *L. spinifer* off branchial cavity of *Rachycentron candus* and *Chironemus tala*. *L. lagocephali* off the body of *Lagocephalus murianus*. *L. Latigenitalis* off inner surface of opercle of *Pseudopristipoma nigra*. *Pupilina brevicauda* off the body of *Mobula diabolus* and *M. lucasana*. *Auretes anomalus* off the gills of *Platax feira*. and *Heniochus acuminatus*. *H. indicus* off gills of *Platax tiera*. *Tuxophorus caligodes* off the body of *Rachycentrol canadus*.T. wilsoni off the body of *Chorinemus lysan*. *T. cybii* off *Cybium commersoni* and *Acanthocybium solandir*. *Euryphorus nympha* off branchial cavity of *Corphaena hippurus*. *Pseudopandarus longus* off *scoliodon sorrakowah*. *Perissopus manuelensis* off Scoliodon sorrakowah. *Nesippus vespa* off *Rhynchobatus* sp. *Lernanthropus decapteri* off gills of *Decapterus russellii*. *L. alatus* off gills of *Selaroides leptolepis*. *L. opisthopteri off gills of Opisthopterus tardoor*. *L. gibbosus* off gills of *Saurida tumbil*. *L. robustus* off gills of *Caranx* sp. *L. sillaginis* off gills of *Sillagosihama*. *L. shishidoi* off gills of *Mugil cephalus*. *L. triangularis* off gills of *Pertica filamentosa*. *L. lappaceous* off gills of *Polynemus plebeius*. *L. priacanthi* off gills of *Priacanthus hamrur*. *L. corniger* off gills of *Megalaspis cordyla*. *L. indicus* off gills of *Caranx sansum*. *L. cornutus*

off gills of *Tylosurus crocodiilus* and *Ablennes hians*. *L. secutoris* off gills of Secutor insidiator. L. oblongus off gills Sardinella Fimbriata. L. giganteus off gills of Caranx sp. L. otolithi off gills of *Otolithus argenteus*. *L. trifoliatus* off gills of Polynemus hepatadactylus, P. sextarius and Eleutheronema tetradactylum. L. cruciatus off gills of Sciaonid fish. L. cadenati off gills of *Megalops cyprinoides* and *Elops senegalensis*. *Lernanthropodes trachinoti* off gills of *Trachinotus blochi*. *L. chirocentrosus* off gills of Chirocentrus dorab. L. chorinemi off gills of Chorinemus lysan. *Sangum epinepheli* off gills of Epinepheles akaara. Norion gibbosus off gills of Lutianus waigiênsis. Eudactylina lancifera off gills of Pristis sp. E. alata off gills of Rhynchobatus sp. Eudactylinopsis curvatus off gills of Pristis sp. Kroyeria sphyrnae off gills of *Arothron stellatus*. *H. elliptica* off gills of *Diodon hystrtix*. H. sphyraeni of gills of Sphyraena acutipinnis. H. foliata off gills of Nemipterus japonicus. Pseudocycnus armatus off gills of *Indocybium guttatum*. *Lernaeenicus hemirhamphi* off Hemirhamphus xanthopterus. (Family Lernaeopodiae) *Lernaeopoda upenei* off buccal cavity of Upeneus vittatus. *Thysanote longimanus* off branchial cavity of Carangoides malabaricus. T. appendiculata off gills arches of Parastromatus niger. T. eleutheronema off branchial cavity of *Polynemus plebeius*. *Pseudocharopinus dasyaticus* off *Dasyatis imbricatus*. *P. narcinae* off gill arches of *Narcine timei* Charopinopsis quaternia off gills of *Coryphaena hippurus*. Clavellopsis appendiculata of gills of Chirocentrus dorab. C. *bilobata* off gills of *Nemipterus japonicus*. *Clavellisa emerginata* off gills of *Thrissocles malabarica*. C. dussumieriae off gills of Dussumieria hasselti. C. chordata off gills of Pellona indica.

Sub-class: Malacostraca

Order: Mysidacea: Mysidaceans look much like little shrimps. Available report shows that only one species—Spelaeomysis longipes—is recorded from fresh—water. All the others listed below are marine organisms: *Boreomysis Tattersallis; B. verrucosa; B. sibogae; Siriella dubia; S. robusta;*

S. jonesi; S. quilonensis; Hemisiriella parva; Rhopalopthalmus tattersallae; Gastrosaccus kempi; G. muticus; G. simulans; G. dunckeri; Acanthomysis pelagica; A. anomala; Heteromysis macropsis and *Anisomysis bacescui*.

Order: Isopoda: Most of these are marine, some live in fresh-water and a few are terrestrial. This Order also includes parasitic forms. The free-living Isopods recorded from Kerala are: *Xanthura orientalis; X. lineris; Cyathura carinata; C. indica; Apanthura sandalensis; Mesanthura maculata; Accalathura borradalei; Paranthura plumosa; Corallana nodosa; Lanocira gardineri; L. rotundicauda; L. zeylanica; Argathona rhinoceros; A. normani; Eurydice inermis; E. pulchra; Cirolana willeyi; C. fluviatilis; C. bovina; Mobula diabolus; Rocinela orientalis; Alitropus typus; Cymodoce longistylis; C. mammifera; Dynoidella amblysinus; Cerceis granulata; Dynamenella quilonensis; Dies quadricarinatus; Sphaeroma terebrans. S. terebrans* is a woodborer and so is of considerable economic importance. These attack underwater wooden structures, especially those standing in esturine waters. Both the adults and young burrow into wood and unlike boring mollusus these migrate causing more damage to the wood. *Synidotea variegata; S. Fluviatilis; Astacilla amblyura; A. gibbosa; Arcturina cylindralis* and *Bagatus longimanus*.

Parasitic Isopods:

Records show that parasitic isopods belonging to two families have been reported from Kerala. Of these, isopods belonging to family Cymothoidae are parasites of fishes, while those belonging to family Bopyridae are parasites of other crustaceans. Reports from family Cymothoidae include *Agarna tartoor* from the gill chamber of *Opisthopterus tardoore*. *A. brachysoma* from the gill chamber of *Pellona brachysoma*. *Indusa malayi* from the gill chamber of *Mugil* ophueseni. *I. pustulosa* from the branchial cavity of *Anodontostoma chacunda*. *Livoneca engraulidis* from the gill chamber of *Anchoviella zollingeri*. *L. circularis* from the branchial chamber of *Culpea leiogaster*.

Pseudirona laeopsi from the gill chamber of *Laeops macrophthalmus*. Parasites belonging to family Bopyridae are represented by *Hypophryxus leptochelae* found attached to the ventral side of the abdomen of *Leptochela aculeocaudata*. *Diplophryxus richardsoni* found attached to ventral side of the abdomen of *Pontophilus* sp. *Tylocephon bonnieri* from the branchial chamber of *Alpheus* sp. Order Amphipoda: Most of the amphipods are marine, but there are fresh—water, semiterrestrial and terrestrial forms also. They may be planktonic or may be found on seaweed, hydroids etc. or rearly parasitic. The present report includes only free—living forms. Members belonging to about 28 families have been reported from Kerala. These are *Urothoe ruber*; *U. grimaldii*; *Paraphoxis rostratus*; *Mandibulophoxus uncirostatus*; *Megaluropus agilis*; *Melita inaequistylis*; *M. nitida*; *Geradocus rubromaculatus*; *Melita inaequistylis*; *M. nitida*; *Geradocus rubromaculatus*; *Maera insignis*; *m. inaequpes*; *m. latibrachium*; *M. trispina*; *Elasmopus spinidactylus*; *E. brasiliensia*; *Pontogeneia subrostrata*; *Perioculodes megapleon*; *Gitanopsis subpusilla*; *Cyproidea ornata*; *Stenothoe gallensis*; *Hyale galateae*; *H. dollfusi*; *H. schmidti*; *H. pontica*; *H. honoluluensis*; *Parahyale hawaiensis*; *Orchestia floresiana*; *Talorchestia spinipalma*; *Tiron breyidactylus*; *Argissa hamatipes* *Atylus minikoi*; *Paradexamine indica*; *Polycheria atolli*; *Ampelisca cyclops*; *A. zambonagae*; *A. brevicornis*; *A. scabripes*; *Hornellia incerta*; *Photis digitata*; *Eurystheus afer*; *E. atlanticus*; *Cheiriphotis megacheles*; *Ampithoe ramondi*; *A. kergueleni*; *Cerapus tubularis*; *Erichthonius brasiliensis*; *Grandidierella megnae*; *Corophium triaenonyx*; *Podocerus brasiliensis* *Vibilia armata*; *V. viatrix*; *Paraphronima crassipes*; *Hyperiooides longipes*; *Phronima atlantica*; *Phronimella elongata*; *Primno macropa*; *Anchylomera blossevillei*; *Phrosina semilunata* *Lycaeopsis zambonage*; *Eupronoe armata*; *Lycae pulex*; *Simorhynchotus antennarius*; *Oxycephalus clausi*; *O-piscator*; *Calamorhynchus pellucidus*; *Glossocephalus milne—edwardsi*; *Platyscelus serratulus* and *Tetrathyrus forcipatus*.

Order; Decapoda: This order includes the familiar shrimp, crayfish, lobsters, crabs etc. This is also the largest order of crustaceans. This order is of great commercial importance as it includes several edible forms. These are mostly marine

organisms, but fresh—water, amphibious and terrestrial forms are also seen. About 22 families under this order has been recorded from Kerala. Considering the commercial importance of this group, a fairly detailed account of their distribution (region—wise and seasonal), habitat etc. are mentioned below:

Aristeomorpha wood—mansoni. Found only in small numbers inhabiting waters at 180—250 fathom.*Aristeus alcocki* obtained in small numbers from trawling off Alleppey at 185 fathoms. *A. semidentatus.* This is of potential commercial importance, recorded off Cochin and Alleppey at 150—200 fathoms. *Atypopenaeus stenodactylus*, recorded all along the west coast. *Hymenopenaeus aequalis* obtained in fairly good numbers from deep sea trawling. Found to occur between 150 and 200 fathoms. M. *mogiensis*, stray catches from Malabar coast. M. *Philippii*, obtained in good numbers in deep sea trawling and is of potential commercial importance. *Metapenaeus affinis.* This is of great commercial value. These are caught mainly during post mosoon months with the peak season falling during October—December. Majority are caught from inshore waters upto 45—50 metres depth. Juveniles are fished in small numbers from backwaters and estuaries. M. *burkenroadii* collected in small numbers from estuarineand inshore waters in Cochin. M. *dobsoni*, one of the major species contributing to the in—shore fishery as well as trawl fishery. Peak catch is during October—November. M. *lysianasa* is a very rare species the South—west coast of Kerala. M. monoceros is an important species from the point of view of marine,estuarineand backwater fisheries. Maximum catch during post—monsoon periods. *Parapenaeopsis acclivirostris* obtained only in small numbers. P. *maxillipedo* and P. *sculptilis* are obtained only in small numbers. P. *stylifera* is strictly a marine form and is caught throughut the year. The peak catch is during September—December. P. *uncta* recorded only as stray catches.*Parapenaeus investigatoris* recorded off Alleppey and Cochin in deep sea trawling usually observed at 175—185 fathoms. P. *longipes* recorded in small numbers off Cochin at 10 fathoms. *Penaeopsis rectacuta* is of potential commercial importance and is obtained in good numbers in deep sea trawling at 180—200 fathoms. *Penaeus canaliculatus* obtained only in small numbers. *P. indicus constitutes one of*

the most important prawn fishery of backwater and paddy—fields. Adults breed in sea. This species is available in the sea almost throughut the year, but commonly fished during post monsoon periods. *P. monodon* adults breed in sea and juveniles enter estuaries and backwaters. *P. japonicus* is another species of potential commercial importance. *P. latisulcatus*, only stray records. *Sicyonia lancifera* reported ony in small numbers at 12—17 fathoms. *Solenocera pectinata*, recorded off Cochin and Ponnani in small numbers. *S. Indica* is found all along the east and west coasts in small numbers. *S. koelbeli* is recorded off Ponnani at 35—40 fathoms. *S. hetii* off Alleppey at 185—200 fathoms. *S. alticarinata S. melantho; S. choprai; Trachypenaeus curvirostris* recorded off Ponnani in small numbers. *T. pescadorensis* is recorded as stray catches only. *T. sedili Gennadas propinquus* and *G. scutatus* recorded off Alleppey at 380 fathoms. *Acetes cochinensis*. Stray specimens recorded from marine and backwater plankton, during May—June. *A. erythraeus* is of commercial importance and is found in large numbers from December to April. *A. indicus* is very rare and records are from stray specimens, from in—shore and backwaters. *A. japonicus* is found in large numbers off Trivandrum in July. *A. serrulatus* is fairly common during December—April, in the coastal waters.*A. sibogue* has only stray records off Quilon. *Sergestes seminudus* recorded off Alleppey at 380 fathoms. *Hippolysmata ensirostris* found all along the coasts of India. *Macrobrachium equidens* is found in fresh and brackish waters in small numbers. *M. idella* is represented in the catches during September—December period in backwaters. *M. rosenbergii* constitutes a good fishery in Kerala during monsoon and pst—monsoon periods, mostly in backwaters. *M. rude*, only stray records of this species mostly from lakesandestuaries *M. scabriculum; M. mirabilis* and *M. lamarrei* are recorded in small numbers in estuaries.and freshwater regions. *Palaemon styliferus*. Only stray specimens have been recorded. *Pasiphaea alcocki*, recorded off Alleppey at 185 fathoms. *Oplophorus gracilirostris* and *Acanthephyra sanguinea* were recorded off Alleppey at 180—205 fathoms. *Heterocarpus gibbosus* is represented in small numbers in deep water trawling off Alleppey at 185—200 fathoms. *H. wood—mansoni* is of potential commercial importance and was obtained in deep

water trawling off Alleppey at 180 fathoms. *Parapandalus spinipes* is of potential commercial importance and was obtained in fairly good quantities in deep water trawling off Alleppey at 150—200 fathoms. *Plesionika ensis* was represented in deep water trawling. *P. martia* is of potential commercial importance and is represented in good numbers in deep water trawling off Alleppey at 150--200 fathoms. *Panulirus homarus* frequents rocky areas and constitutes a good fishery during December to April. *P. penicillatus* is recorded off the coast of Quilon and is very rare. *P. longipes* and *P. polyphagus* are rare along the southwest coast. *P. ornatus* inhabits shallow waters and is found only occasionally along Kerala coast, so also *P. versicolor*. *Palinustus mossambicus* is a deep sea form occurring at 70—400 fathoms and constitutes a fishery of potential commercial importance. *Puerulus sewelli* is another deep sea form occurring at 180- 300 m. and forms fishery of potential commercial importance. *Nephropsis carpenteri* was recorded off Alleppey. *Callianassa (Callichirus) maxim* was recorded from Kayamkulam lake. *C. (C) audax* off Malabar coast. *Munida squamosa*; *M. japonica* and *Munidopsis scobina*.

Dromia rumphii, obtained at 10 fathoms; *Dorippe dorsipes* obtained in seine net. *Calappa lophos*, abundant between 5 and 15 fathoms; *Matuta lunaris* usually found in sandy bed of sea, but migrates into backwaters to void high salinity variations; *M. planipes* is a common species; *Nursia abbreviata* found on the weedy surface of rocks in the littoral region; *N. rubifera* inhabits the rock crevices filled with shell fragments. Breeds between Augusts and November; *Philyra globulosa* inhabits sandy and ooze-like soft mud areas of the sea. *P. scabriscula* found in the sandy regions of the sea upto 10 fathoms. Breeds during November—February; *Achaeus lacertosus* obtained at 10 fathoms in a beam trawl; *A. tenuicollis* inhabits same areas as *A. lacertosus*; *Buenia platyrostrata* inhabits the rocky regions of the coast where there is profuse growth of algae. Breeds between June and September; *Simocarcinus simplex*; *Menaethius monoceros* inhabits the rocky regions overgrown with sea weeds. Breeds between July and October; *Acanthonyx macleayi*, common among weeds on rocks and boulders in the littoral region. Breeds between June and August; *Hyastenus planasius*; *H.*

pleione; *Doclea canalifera* inhabits muddy bottom of the sea between 10 and 15 fathoms; *Lambrus longimanus*, obtained in beam trawl. *Scylla serrata*, edible and of commercial importance. Commonly found in all esturine and backwater areas; *Portunus (=Neptunus)pelagicus*, edible and of commercial importance. Primarily a marine form, but migrates into backwaters at times. *P. (=N)sanguinolentus*, edible and of economic importance. Abundantly found in sandy regions of the sea between 5 and 15 fathoms and sometimes moves into the backwaters. *P. (=N) (Amphitraite) gladiator* commonly found between 10 and 15 fathoms in areas with sandy beds; *P. (N) (A). argentatus*, frequents sandy bottom of the sea at 10—15 fathoms. Breeds between December and January; *Charybdis (Goniosoma) crucifera* is an edible species; *C. (G). annulata* edible and of commercial importance. A common species in all the rocky regions of the coast. Breeds between May and July; *C. (G). natotor*; *Thalamitta wood—mansoni* found in all the rocky regions of the coast inhabiting crevices in the submerged rocks. Breeds during May and July. *Paratelphusa (Barytelphusa) jacquemontii* found on rocks and boulders in freshwater bodies; *P. (B). lamelli frons*; *P. (B). pollicaris*; *P. (Ozhiotelphusa) hydrodromus* found in paddy fields in the low lying areas and often causes damage to paddy. Breeds during July—September; *P. (O). bouvieri*, found in low lying paddy fields. Breeds during June—August; *Gecacinus (Cylindrotelphusa) steniops* frequents low lying paddy fields and dry lands. *Euxanthus melisa* inhabits crevices in rocks within tidelimits; *Menippe rumphii* common edible species usually found among partially submerged rocks in the littoral region; *Ozius tuberculosus* edible species usually found in rocky regions; *O. rugulosus* lives within tidal limits inhabiting crevices in rocks; *Pilumnus hirsutus*; *P. verrucosipes* usually lives among weeds on submerged rocks; *Eurycarcinus orientalis* usually lives in the littoral regions among the rocks overgrown with sea weeds; *Pinnotherus sanguiloriae* obtained from mantle cavity of *Sanguinolaria diphosa* bivalve mollusc inhabiting backwaters; *O. cordimana*, found along with *O. platytarsus*; *Gelasimus annulipes* inhabits mud flats of theestuarineregion; *G. marionis* inhabits mud flats of backwaters; *Dotilla mycteroides*, in-habits muddy regions in small colonies; *Macrophthalmus travancorensis* found along with *G. marionis* and *D. mycteroides*. *Grapsus*

grapsus found among rocks on sea shore. Breeds during August—September; *G. strigosus* found along with *G. grapsus*. Breeds during July—August; *Metapograpsus messor*, common species found on sea ward side of lakes inhabiting crevices on embankments; *M. maculatus*, habits and habitat same as *M. messor*; *Varuna litterate* an edible form collected from open sea; *Sesarma (Sesarma) quadratum* found all along the backwater regions. Breeds from June September; *S. (S). pictum* lives along the muddy banks of backwaters; *S. (S). edwardsi* is a rather rare species; *S. (Sarmatum) punctata* inhabits muddy region of backwaters; *S. (Metasesarma) rosseauxii* is an abundant species; *Plagusia depressa* var. *squamosa* inhabits rocky and open areas of the sea.

Class: *Insecta*:

This is the largest group of animals, in fact, this is larger than all the other animals combined. Insects as a group are of great importance to human society and the study of insects which are variously related to welfare of mankind of referred to as **economic** entomology. From the point of view of their economic importance insects are generally categorised into three convenient groups: harmless, injurious and beneficial forms. They are impediments to human welfare when they attack and destroy crops and carry diseases to crops, **domestic** animals and to human beings themselves. They are beneficial when they yield products like honey, lac, cantharidine, cochineal (dye) or pollinate useful fruit—bearing plants etc. Although these are essentially terrestrial animals and have occupied virtually every conceivable niche on land, insects have also invaded aquatic habitat. Remarking on the distribution and habitat preference Mani (1968) writes "Insects occur everywhere, from the frozen Antartica to the scorching sun of the tropics, in water, on land, in air, in rivers, in lakes, ponds, deep wells, caves, springs, dry deserts, high mountains and even in sea. They are abundant in the garden and field, inside the roots and stems, within unhapened buds, among the petals of flowers and inside ripening fruits, in the store, factory, office, laboratory, museum or library. They are at home with us in our houses, on

our bodies and on the bodies of our domesticated animals". They transmit dreaded diseases like malaria, filariasis, dysentery, cholera, plague etc. to human beings. Likewise insects also carry diseases to domestic animals like cows, buffalos, bullocks, sheep, goat, horses and fowls. Of the 33 orders of insects recognised, according to the present available literature at least 15 have recorded from Kerala. No doubt many more are awaiting future surveys.

Of such an interesting group of animals, asbrief a report as possible is given in the following pages highlighting, the salient features of their distribution ecological relatinships etc.

Order : Odonata

Lestes malabarica; L. elata and *L. procemorsa* breed in ponds and tanks in low country areas. *Ceylonolestes davenporti. Protosticta gravelyi* seen abundantly during May to June and September and October. *P. davenporti* frequents hilly areas at about 915 to 1200 m. elevation. *P. antelopoides; P. sanguinostigma; P. mortoni; P. hearseyi; Platysticya deccanensis; Copera vittata; Caconeura verticalis annandalei; Disparoneura souteri; Indoneura ramburi; I. risi, Melanoneura bilineata* found at elevations of about 900 to 1200 m. *Esme cyaneovittata; E. mudiensis; Phyloneura westermanni Pseudagrion microcephalum*, entirely a creature of the plains and breeds in lakes and marshes. *P. malabaricum; P. indicum* frequents elevations of about 600 to 1200 m. *Archibasis mimetes praeclara; Ceriagrion rubiae; C. olivaceum* race *aurantiacum; Aciagrion ociidentale* frequents foot-hill country. *Agriocnemis piersis; A. splendidissima; Mortonagrion varralli; Onychargia atrocyana. Rhinocypha bisignata* submotane insect living and breeding between 600 and 1800 m. elevations. *Calocypha laidlawi; Libellago lineata indica* is found throughout the year. *Dysphaea ethela; Indophaea dispar* found at elevations of about 1100 to 2000 m. *I. cardinalis* found in sholas frequenting montane streams from April to October. *I. fraseri* frequents hills upto **1100 m.** elevations and are found during May-August period. *Neurobasis chinensis chinensis* breeds in montane and submontane streams at 1000-1200 m. elevations. *Vestalis gracilis montana* found at 1100 m. elevation. *Burmagomphus pyramidalis* seen abundantly during May-July. *B. laidlawi; Davidioides*

martini; *Mesogomphus lineatus* breeds in still as well as running waters. *Lamelligomphus nilgiriensis* frequents shadymountain streams. *L. malabarensis*. *Meghalogomphus hannyngtoni* frequents banks of mountain streams. *M. superbus* frequents mountain streams. *Merogomphus longistigma longistigma* inhabits montane streams, at altitude about 600 m. *M. 1. tamaracherriensis* inhabits marsh lands or bogs at foot-hills. *Heliogomphus promelas* found in small mountain streams. *Acrogomphus fraseri* frequents hilly areas. *Macrogomphus wynadicus* adults are rarely seen but larvae and exuviae are seen abundantly. *Ictinus rapax* very common insect breeding both in still and running waters. *Gomphidia kodaguensis* frequents montane areas but scarce.

Order : Embioptera

Oligotoma minuscula collected while attracted to light. *O. saundersii* from under the bark of mango tree. *O. ceylonica ceylonica*, a commensal in the nest of social spiders. *O. humbertiana*, a common in South India, collected while attracted to light.

Order : Dermaptera

Diplatys lefroyi; *Psalis dohrni*; *Forcipula quadrispinosa*; *Chelisoches morio*, *Adiathetus dravidius*. *Euborellia plebeja* attacks the pods of groundnut and feed on kernels.

Order : Isoptera

To this ordér belongs the termotes. Eight species have been recorded from Kerala : *Postelectrotermes bhimi*; *Coptotermes ceylonicus*; *Heterotermes malabarica*. *Odontotermes obsesus*, *Microtermes obesi* and *Eutermes hoemi* attack coconut seedlings, areca palm and sugar cane causing damage. *M. obesi* is also a pest of groundnut attacking the pods. *Synhamitermes quadriceps* and *Labiocapritermes* sp. are the other records from the State.

Order : Phthiraptera

To this order belongs the sucking and biting lice. These are parasitic on mammals and birds. *Polyplax spinulosa* is a parasite or rats. *Pediculus humanus* is the common human louse. *Haematomyzus elephantis* is parasitic on elephants. *Goniodes payonis* is a parasite of peacock.

Order : Thysanoptera

To this order belongs trips which are largely phytophagous (plant feeding) insects. These attack diverse kinds of plants, which they puncture and suck the sap. They cause yellowing

of the leaves, crumpling and curling of leaves and petals and also cause formation of galls. Certain species act as vectors of viral and fungal diseasers of plants. The account of thrips given in the following pages is based on the published records of Ananthakrishnan, Bhatti and M. R. G. K. Nair.

Erotidothips miravilis and ***Merothrips indicus*** were collected from dry twigs. ***Asprothrips indicus*** from leaves of Arrowroot. The flower Thrips ***Dendrothrips jasminum***. Nair (1978) reports this to be present in Kerala and found in the flower of jasmine. ***D. sexmaculatus*** from Carissa sp. The Leaf Thrips ***Pseudodendrothrips dwivarna***, is reported to attack leaves and shoots of jak. ***Kazinothrips luridus*** from flowers of Barleria sp. The Coffee Thrips from flowers of Barleria sp. The Coffee Thrips ***Scirtotrips bispinosus***. According to Nair (1978) this thrips is found in Kerala and attacks leaves of coffee plant. The Chillies Thrips ***S. dorsalis*** is reported to be a pest of castor, chillies, Acacia etc. The Cane Thrips ***Neolimothrips binervis*** ***(Bregmatothrips binervis ?)*** from leaves of sugar cane and grasses. The Cardamom Thrips ***Sciothrips cardamom*** is listed by Nair (1978) as a pest of cardamom in Kerala. This thrip breeds and feeds on all parts of the plant. These are abundant during December-April. ***Dendrothripoides innoxius*** from ***Ipomea staphylina***. ***Rhamphothrips jasminae neritus*** and ***Agriothrips brevisetosus*** were recorded from ***Ailanthus*** sp. and Bamboo spindles respectively. ***Ayyaria chaetophora*** attacks flowers of cowpea ***(Vigna catiang)*** and country bean ***(Dolichos lablab)***. The Paddy Thrips ***Baliothrips biformis*** is a pest of rice plant in Kerala according to Nair (1978). ***Baliothrips graminis***; ***Bolacidothrips graminis***; ***Bolacidothrips graminis indicus*** and ***Danothrips setifer*** were recorded from grass, bamboo spindles etc. The Flower Thrips ***Chaetanaphothrips signipennis*** from flowers of Banana. ***C. orchidii*** from leaves of Rutaceous plants. The Flower Thrips ***Frankliniella dampfi*** is listed by Nair (1978) as found in jasmine flowers in Kerala. The flower Thrips ***Megalurothrips distalis*** is a pest of groundnut. ***Taeniothrips longistylis*** infests flowers of ground nut and cow pea. The composite Thrips ***Microcephalothrips abdominalis*** infects compositae flowers. Flower Thrips ***Thrips florum*** is listed by Nair (1978) and is reported to infest flowers of Banana and rose. ***Thrips latis*** from cow pea and grass. Athrips heveae infests flowers of rubber plant. ***Astrothrips asiaticus*** from ***Pongamia***

glabra and Castor leaves. The Flower Thrips *A. parvilimbus* infests flower of Banana (Nair. 1978). *Caliothrips indicus* infests shoot of ground nut (Nair. 1978). The Banana Leaf Thrip *Helionothrips kadaliphilus* infests leaves of Banana, Colacasia and grass. The Green House, Cotton Thrip Citrus Thrips *Heliothrips haemorrhoidalis* infests leaves of citrus and croton *H. ceylonicus* infests Crotton, Coffee etc. The Turmeric Thrips Leaf Thrips *Panchaetothrips indicus* infests leaves of turmeric, Arrowroot, banana, cotton etc. The Cocoa Thrips, Redbanded Thrips *Selenothrips rubrocinctus* infests Aprosa, Cardenia flowers and Cashew nut leaves. Nair (1978) states that *Retithrips syriacus* infests tender leaves of Cashew in Kerala. The Grapewine Thrips *Rhipiphorothrips cruentatus* infests leaves of **Areca**, Cashew, Pomogranate and Crotons. *Bradythrips hesperus; Stephanothrips occidentalis* and *Adraneothrips elegans* were recorded from dry and decaying twigs. *Aeglothrips denticulus* and *Androthrips flavipes* were recorded from galls of *Gymnosporia* sp. and *Mimusops elongi* respectively. *Aleurodothrips fasciapennis* from Bamboo, Palmyra leaf etc. *Apelaunothrips lucidus* from dry grass. *A. madrasensis* from decaying vegetation. *Antilothrips malabaricus; A. nayari and A. varius* from bamboo and dry twigs. *Austrothrips cochinchinensis* from galls of *Calycoptoris floribunda*. *Azaleothrips ambilis* from dry twigs. *Bunothrips cruralis* from fungers infested roots and barkscrappings. *Chlarathripstersus* from grass. *Corycidothrips inquilinus* from galls of *Terminalis chebula*. *Crotonothrips memecylonicus* from galls of *Terminalia chebula*. *Crotonothrips memecylonicus* from galls of Memecylon. *C. miminus* from galls of *Seacamone emetica*. *Dixothrips onerosus* from leaf pouch galls of *Terminalia chebula*. *Dolichothrips confusus* from leaf buds of *Diascorea* sp. *D. indicus* from shoots of Cassia emarginata. Cochlospermum gossypium, Persian Nim etc. *Ecacanthothrips tibialis* from barks of Neem, Moringa etc. *Euoplothrips malabaricus* from *Piper nigrum*. *Eurhynchothrips ordinarius* from mango leaves. *Giganthothrips seshadrii* from Terminalia leaves. *G. tibialis* from *Coreya arborea*. *Glubothrips mucidus* from dry and decaying twigs. *Gynaikothrips malabaricus* from leaves of *Ficus bengalensis*. *Haplothrips longisetosus* from wild flowers. *H. ceylonicus* from jasmine. The Cereal Thrips *H. ganglbaueri*. Nair (1978) lists this as a pest of rice and jasmine in Kerala. *Hoplandrothirps flavipes* from decaying coconut

sheaths, wild palm sheaths etc. *Hoplothrips angusticeps* from dry twings. *H. nemorius* from dry twings. *Karnyothrips alpha* from Bamboo. *K. fungulus* from decaying wood. *K. melaleucus* from Bamboo and wild grass. *K. mucidus* from dry twigs. *K. nigriflávus* from Bamboo grass. *Kochummania excelsa* from galls of *Litsea* sp. *Leeuwenia vorax* from galls of *Eugenia* sp. *Liophaeothips ablusus* from galls of *Urticiaceae* plant. *L. dentipes* from leaves of wild plants. *L. pictus* from dead and decaying wood. *L. succintus* from galls of wild plants. *Liothrips atèr* from gall. *L. cecidii* from galls. *L. chavicae* from leaf and gall of Pepper. *L. eugeniae* from galls of Eugenia. L. flavescens from gall. *L. furvus* from galls of *Schofflora* sp. *L. gracilis* from leaves of *Planchona* sp. *L. interlocatus* from galls of Terminalia leaves. The Marginal Gall Thrips, Pepper Leaf Gall Thrips *L. Karnyi*. Nair (1978) lists this as a pest on peper producing leaf galls. *L. machilus* from leaf galls of *Machilus macranthis*. *L. nubilis* from galls. *L. pallipes* from tender leaf rolls of peper. *L. strigosus* from galls of *Cinnamonum* sp. *L. viticola* from galls of *Vitis* sp. *Margaritothrips sumatrensis* from dry twigs of chillies. *Mesandrothrips inquilinus* from galls of *Pavetta*. *Mesothrips extensius* from galls of *Anogeissus* sp. *M. melinocnemis* from galls of *Poths scandens*. *Neoheegeria hrasvanukha* from *Mallotus philipinensis*. *Neothrips lepidus* from dried root of wild tree. *Ocnothrips indicus* from galls of peper. *Opinothrips corticulus* from dry twigs. *Phenothrips decoratus* from grass. *Phiarothrips reperticus* from grass. *Phorinothrips levis* from galls of *Vitus* sp. *P. minusculus* from galls of *Loranthus* sp. *Plectrothrips pallipes* from dry twigs. *Pygmaeothrips columniceps* from decaying coconut sheath. *Ramakrishniella unispina* from leaves of wild plants. *Rhychothrips raoènsis* from leaf falls of *Mallotus philippinensis* and flowers and leaves of Cashew. *Segnothrips trivandrensis* from grass. *Stigmothrips bambusae* from dry bamboo spindles. *S. consimilis* from fungus infested dry leaves and twigs. *S. limpidus* from dry bamboo spindles. *Tetradothrips faoliperda* from galls of *Pothos scandens*. *Treherniella liferna* from grass. *Xylaplothrips debilis* from dry twigs. *X. emineus* from dry twigs. *X. inquilinus* from galls of *Pavetta* sp. *X. micans* from *Lantana* sp. *X. pictipes*, from diseased berries of black peper. *X. pusillus* from dry Smilax twigs. *Allothrips pillichellus* bicolor from Bamboo leaves. *Bactrothrips*

idolomorphus from dry and decaying leaves of wilds trees. *Decothrips anacardii* from fungus infested bark of *Anacardium occidentale*. *Diaphorothrips unguipes* from dry twigs. *D. vitreipennis* from dry twigs. *Dichaetothrips niger* from Areca sheaths and dry teal branches. *Dinothrips sumatrensis* from dry twigs of *Sesbania* sp. *D. spinosus* from log of *Mallothus philippinensis*. *Elaphrothrips denticollis* from dry leaves. *E. notalilis* from dry Areca sheath, dry leaves etc. *E. procer* from dry Areca sheath, dry coffee twigs etc. *Gastrothrips acuticornis* from dry twigs. G. *falcatus; Machotothrips corticosus; M. indicus; Meiothrips menoni; Neosmerinthothrips fructuum; N. robustus; Nesidiothrips alius; Nesothrips brevicollis; Mecynothrips simplex; Polyphemothrips cracens; P. indicus; Priesneriana kabandha; Pygothrips amplus; Pyrgothrips faurei* and *Scotothrips claripennis* were collected from dry twigs.

Super Order

Hemipteroidea. Under this superorder are included two orders : Heteroptera and Homoptera. These are bugs with piercing and sucking mouth parts. To these orders belong the blood sucking Bed-bug, plant feeding aphids, cicadas, tingid bugs etc. Though mostly terrestrial, there are some secondarily adapted to aquatic habitat. Some of them act as vectors of several plant diseases especially the relationship between aphids and plant viruses is well established.

Order : Heteroptera

Gerris fluviorum; G. nitida; Cylindrostethus productus; Physorhynchus malabaricus; Rhaphidosoma atkinsoni; Sycanus affinis; Epidaus bicolor; Panthous bimaculatus Tea Mosquito *Helopeltis antonii nymphus* and adults attack tender leaves and stem of tea plant. These are also pests on cashew feeding on blossoms with a peak infestation period during January; Guava, attacking fruits and Cocoa, attacking young pods. The adults and nymphs of the Spindle Bug *Carvalhoia arecae* such sap from areca palms. It is seen throughout the year, but peak population is observed during August-September. The adults and nymphs of the Sunhemp Mirid *Ragmus imporunitas* feed on sap of green manure plants like Sunhemp. *Buchananiella*

crassicornis; B. carayoni,; Orius indicus; O. siyamavarna; O. trivandrensis Carayonocoris indicus. Cimex semiptirus, the common bedbug is familiar to all. The Red Bug **Dysdecus cingulatus**. Both nymphs and adults of this bug feed on sap from leaves and shoot of Lady'sfinger plant. *Physopelta quadriguttata; Antilochus lineatipes; Melamphaus fulvomarginatus; Odontopus sangunolens'* The Lacewing Bug **Stephanitis typicus** is a pest on coconut, Colocasia. Cardamom, turmeric and banana. These are found abundantly on coconut during March-May period. Mostly these attack leaves of their host plant. The Brinjal Lacewing *Urentius hystricellus* (=*echinus*) is a pest on brinjal plant where adults and nymphs feed on sap from leaves. The nymphs and adults of the Lacewing Bugs **Cochlochila bullita** (*Monanthia globulifera)* are pests on Tulsi and coleus plants. The Lacewing *Corythauma ayyari* attack leaves of jasmine. The adults and nymphs of the pod Bug *Aphanus sordidus* attack the pods of grodndnut. The adults of the Green Lygaeld *Nysius inconspicuous* feed on tender shoots and pods of seasamum. *Oncopeltus nigriceps; Graptostethus servus Pyrrhobaphus leucurus* (vide Fauna of British India) The adults of the Rice Bug *Leptocorisa acuta* is a pest on rice plants, cocoa and clove. These feed on the milky contents of the tender rice grains. It also feeds and breeds on various types of grasses. The adults of the Nut Crinkler, Nut Bug Coreid Bug **Paradasynun rostratus** are pests on coconut, cashew and Guava, feeding on fruits and leaves. The adults and nymphs of the Coreid Bug/Pod Bug *Riptortus pedestris* suck juice form seeds in pods of pulses and from tender leaves of cardamom. *Clavigralla gibbosa* and C. *horrens* are pests on pulses. In addition to these pests, other Coreid bugs described from Kerala (vide Fauna of British India) are : *Anoplocnemis phasiana: Homoeocerus angulatus; Leptocorisa varicornis* and *Riptortus fuscus*.The nymphs of the Striped Bug *Tetroda histeroides* and the Redspotted Earhead Bug *Menida histro* infests rice plants sucking sap. The adults of the Shield Bug **Aspongopus janus** suck sap from fruits and plants of cucurbits. The Lablab Bug **Coptosoma cribraria** and the Green Shield Bug *Nezara viridula* are pests of pulses. In addition to these, 24 species of pentatomids have been described from Kerala (vide Fauna of British India). These are :*Cantao ocellatus; Poecilocoris pulcher; Scutellera nobilis;*

Chrysocoris superbus; C. stockerus; Cephalocteus melolonthoides; Stibaropus tabulatus; Erthesina fullo; Halys dentatus; Sciocorsis indicus; Laprius varicornis; Cappaea taprobanesis; Niphe subferruginea; Halyomorpha picus; Tolumnia latipes; T. antennata; Placosternum taurus; P. dama, Rhynchocoris erratus; Catacanthus incranatus; C. mirabilis; Nezara viridula; Cazira verrucosa and *Tessaratoma javanica*. The two species of water bugs reported from Kerala are : *Belostoma indicum* and *Entithares triangularis*.

Order : Homoptera

The adults and nymphs of the Cane Leaf Hopper *Pyrilla perpusilla* and the adults of the Black Leaf Hopper *Assamia moesta* are pests on sugar cane, sucking sap from the plant. The adults of the Fulgorid Bug *Eurybrachys tomentosus* occasionally feed on leaves and pseudostem of banana. The adults of the Moth Bug *Ricania fenestrate* and the adults and nymphs of *Flata ocellata* are pests of jasmine. In addition to these pests the othêr fulgorids described from Kerala (vide Fauna of British India) are : *Pyrops dohrni; Fulgora oculata; F. deleserti; Kelidasa albiflos; K. dives; Eurybrachys venusta; Messena pulverosa;M.sinuata;Thessitus insignis; Pochhazia interrupta; varcia hemerobii; Phromnia viridula; Anggira typica; Lechaea dentifrons; Scarpantina bimaculata; Melicharia quadrata* and *Atracis cretacea*. The Brown Plant Hopper *Nilaparvata lugens* is a pest of rice plant attacking during the periods of

October-November to January-february. The adults and nymphs of the Rice Plant Hopper *Sogatella furcifera* are also pests of rice sucking juice from the plant. *Purohita cervina; Perkinsilella insignis; Phyllodinus pulchellus; P. sauteri; Peregrinus maidis; Sardia rostrata; Liburnia furcifera; L. Pallescens L. pusana; Dicranotropis cognata; Sogata rhodesi; Delphacodes propinqua* and *D. crawfordi. Platypleura polita; Gaeana atkinsoni; Balinta delinenda*. Both adults and nymphs of the Cow Bug *Anchon pilosum* cause damage to pulses. Adults and nymphs of the Tree Hopper *Gargara* sp. feed on the tender shoots of cocoa plant. *Centrorypus ortus*. Both adults and nymphs of the Spittle Bug *Aphrophora nuwarana* are pests on cardamom. The

adults of the Spittle Bugs *Cosmoscarta ralata* and *Clovia lineaticollis* attack leaves of jack tree. The Spittle Bugs *Phymatostetha deschampes* feed on both banana and cocoa plants while *Peuceptyellus sigilifer feed* on cocoa. *Ptyelus praefractus; Phymatyostetha circumducta; P. hilaris; P. stellata; P. deschampsi; Cosmoscarta thoracica;* C. putamara and C. *fuscipennis.* The Green Leaf Hopper *Nephotettix virescens* and N. *nigropictus* are pests of rice plant. The Leaf Hoppers *Amrasca biguttula biguttula* and *A. splendens* are pests on Lady's Finger and Mango respectively. The Mango Hoppers *Amritodus atkinsoni; Idioscopus clipealis* and *I. niveosparsus* are pests ol mango tree. The Leaf Hopper *Tettigoniella ferruginea* is a pest of cardamom feeding on the sap of the plant. These are found in large numbers during May-August. The Leaf Hoppers *Idioscopus clypealis; Bothrongonia* sp.; *Krisna* sp. *Kurtara brunnescena; Balocha* sp. and *Coelidia* sp. are pests on cocoa plant. *Petalocephala brachycephala; Ledra intermedia* and *Goniagnathus puctifer.*The nymphs of the Leaf Psyllid *Microcerpopsylla* (*Pauropsylla) brevicornis* feed on leaves of mango tree. The adults and nymphs of the Citrus Psylla *Diaphorina citri* attack citrus plant. The Mealy Wings *(Aleurolobus barodensis)* and *Neomaskellia bergii* are pests of sugarcane. The White Fly *Dialeurodes cardamomi nymphs* feed on leaves of cardamom. The white Flies *Dialeurodes kirkaldyi* and *Aleurocanthus rosae* are pests on jasmine and rose respectively. The Mealy Wings *Aleurocanthus spiniferus* and *Siphonimusphillyrea finitimus* are pests of citrus and pomegranate respectively. The Rice Root Aphid *Tetraneura nigriabdominalis* are pests on rice plant. *Aphis craccivora* infests groundnut plant and pulses. *A. malvae* attack lady's finger. *A. gossypii* infests brinjal and cucurbits, while *A. traversi* is a pest of citrus. *Pentalonia nigronervosa* is a pest on colocasia, cardamom and banana. *Toxoptera aurantii* attack tender stem, leaves and buds of tea plant. It is also a pest on cocoa. T. *odinae* is a pest on mango and cashew trees. *Cerataphis lantanaie* and *C.variabilis* infest inflorescence of areca palm. The Mealy Bug *Icerya aegyptica* is occasionally seen on leaves of banana but is not known to be a pest. These do infest areca palm also. *Aspidiotus destructor* infests coconut, rubber and areca *A. Cynanophylli* attacks leaves as well as

infloresenceof rubber plant. The Rhizome Scale *A. hartii* infests the rhizomes of ginger and turmeric. Scale Insect *A. camelliae* infests tea plant. The Scale *Aonidomytilus albus* is a pest of tapioca. The Pepper Scale *Lepidosaphes piperis* infests stem, leaves and petioles of pepper plant. *Mytilaspis* sp. infests berries, their stalk and *pseudostem* of cardamom. *Hemichionaspis theae* infests tea plants. The Armoured Scale *Chionaspis dilatata* attack areca palm and banana while *C. vitis* is á pest on mango tree. The Red Scale *Aoindiella Aurantii* is a pest on citrus, jasmine and rose plants. The Scale Insects *Lacanium hesperidum* infests amaranthus; *L. viride* attacks coffee, guava and citrus; L.*formicariae* infests tea plant; *L. latioperculum* is a pest on cashew; and *L. acutissimum* is a pest on banana. *Pulvinaria duratee* is a pest on amaranthus. The Soft Scale *Marsipococcus (Lecanium) marsupiale* infests foliage and vine of pepper. The Red Bug *Saisettia hemisphericum* infests tea, coffee and guava. These are parthenogenetically reproducing forms, males being unknown. The Black Scale *S. nigra* infests coffee and rubber. The Soft Scale *Coccus hesperidum* attacks leaves and inflorescence of areca palm. The Wax Scale *Ceroplastodes cajani* infests tender leaves of pulses. The Soft Mealy Scale *Pulvinaria psidii* is a pest on mango infesting leaves. These also attack guava. *C. rubens* and *C. floridensis* are pests of mango and cashew respectively. The Soft Scale *Vinsonis stellifera* sometimes feeds on leaves of banana but causes no damage. Rice Mealy Bug *Heterococus rehi* is a dry season on rice plant. Nymphs and adults feed on the stem. The Mealy Bugs *Pseudococcus longispinus* infests leaves and inflorescenceof coconut; *P. citri* attacks different parts of citrus plant; *P. citriculus* attack leaves and inflorescence of area palm; and *P. ornatus* infests tender shoot and buds of jasmine. The nymphs and adults of the Cane Mealy Bug *Sacchariococcus sacchari* feed on the sap of sugarcane. The Brinjal Mealy Bug *Coccidohystrix insolita* (*Centrococcus insolitus)* infests leaves and tender shoots of brinjal. The Mealy Bug *Ferrisiana virgata* infests vine and berries of pepper plant. The Mealy Bugs *Planococcus citri* and *P. lilacinus* are pests of coffee. *P. lilacinus* attacks cashew, cocoa and Pomegranate also. *Rostrococcus iceryoides* and *Dysmicoccus breyleceps* attack leaves and infloruscence of areca palm. Mealy Bug *Phenacoccus mangiferae*

and *Idioceryoides* infests tender leaves and shoots of mango. Mealy Bug *Ferrisia virgatus* is a pest of cashew, citrus and jasmine.

Order: Coleoptera:

This largest order of insects consists of beetles, weevils etc., with hard bodies and chewing mouth parts. Most of these are plant feeders or are predaceous on other insects. Some are aquatic. Coleopterans belonging to at least 20 families have been recorded from Kerala some of which are pests of crops, others pests of stored grains, some eat away wooden structures and furniture at home. Such are the varied influence of these insects on human society.

Hydrovatus confertus; Peschetius quadricostatus; Canthydrus ***laetabilis; C. luctuosus; Laccophilus ellipticus; Cybister limbatus; Copelatus cryptarchoides; Lacconetus (Paralacconectus) scholzi; Scarites praedator; S. laticeps; Oxylobus follis; O. alternans; O.*** **dispar;** ***O. porcatus; O. asperulus; O. montanus; Thlibops glaber;*** **Sparostes** ***striatulus; Coryza maculata; Clivina forcipata;*** **Leptacinus** ***nilamburensis; Pilonthus bengalensis; Staohylinus (Platydracus) suspectus; Pinophilus aegyptius; P. malabarensia; Cryptobium nilamburense; Bledius brunnipennis; B. (pucerus)*** **tuberculatus; B. maindroni; B. pulchellus;Holotrochus annandale** Adults and grubs of the Root Grub ***Phyllognathus dionysius*** are pests on rice plant. The adults of the Rhinoceros Beetle **Oryctes** ***rhinoceros*** attack tender shoot of coconut palm. Peak period of infestation is during July-September. These attack areca palm also, boring into unopened spathes. The Trunk Borer ***Xylotrupes gideon*** occasionally bores into the trunk of coconut palm. The Chafer Beetle ***Popillia complanata*** feeds on the leaves of cocoa plant. ***Gymnopleurus cyaneus; G. koenigi G.*** **gemnatus;** ***G. maculosus; G. dejeani; G. aethiops; G. sinuatus; Sisyphus hirtus; Catharsius molossus; C. capucinus; Copris*** **indicus;** ***C. signatus; C. davisoni; Phalops divisus; Caccobius*** **aterrimus;** ***C. meridionalis; Onthophagus; caesariatus; O. abacus; O. spinifex; O. coorgensis; O. parvulus; O. pygmaeus; O. castetsi; O. rectecornutus; O. acuticollis; O. abreuoi; O. negligens; O. vividus; O. quaestus; O. amphicoma; O. furcillifer; O. quadridentatus; O. laevigatus; O. turbatus; O. unifasciatus; O. malabarensis; O. cervus; Cassolus humeralis; Oniticellus pallipes; O. spinipes; Drepanocerus setosus; Onitis falcatus; O. philemon; O. virens.*** The Coconut Root Grub ***Leucopholis coneophora*** feeds on roots of Coconut palm. Adults emerge in large numbers

in June. The Soil Grub *L. pinguis* feeds on roots of nursery plants of rubber. The Root Grub *L. burmeisteri* feeds on roots of areca palm. The Chafer Beetles *Adoretus lasiopygus* and *A. lithobius* are pests of coconut, while *A. ovalis* attack garden plants. Adults of the Chafer Beetle *Anomala varians* attack areca garden plants. The Flower Beetle *Popillia complanata* feeds on flowers and flower buds of cashew. Flower Beetle *Oxycetonia versicolour* is a pest on groundnut, lady's finger, cashew and rose feeding on flowers, leaves and tender shoot. The Flower Beetle *Mylabris pustulata* is a pest on groundnut, lady's finger, cucurbits and pulses, feeding on flowers. The Bark Beetles Cryphaeus taurus; Brysax tuberculatus; Cetopria *induta* are pests of cocoa plant *Tribolium Castaneum* attacks stored grains, vegetable powders, dry fruits, oil cakes, nuts etc. *Pedanus vestitus; Beccaria pallida; Cyclotoma monticola; Saula ferrugnea.* The Epilachna Beetle *Epilachna vigintiocto-punctata* grubs are pests on brinjal and cucurbits. This is thought to be a serious pest of bitter gourd, both the adults and grubs feed on leaves. Megalodacne brachycera; M. pubescens and Amblyopus colombonicus. The grubs of the White Stem Borer *Xylotrechus* quadripes bores into stem of coffee plant and feed on the internal tissues. Adults emerge during April-May and eggs are laid during October-November. The grubs of the Stem Borer *Batocera rufomaculate* are pests of mango and rubber, boring into the stem. The grubs of the Lesser Stem Borer *Plocaderus obesus* bore into the stem and root of cashew tree. Pterolophia annobonae and *Glenea* sp. are pests of cocoa plant. The grubs of the Stem Bores Chloridolum alcmene and *Chelidonium* cinctum bore into stem of cirtrus plant, causing damage. *Logaeus subopacus; Priotyrannus mordax: Acantho-phorus serraticornis; Zoodes compressus; Plocaederus ferrugineus; Xoanodera amoena; Rosalia lateritia; Purpuricenus sanguinolentus; Zonoplerus consanguineus; Polyzonus tetraspilotus var megaspilus;* Pachylocerus crassicornis; Xylotrechus subscutellatus;. The Rice Hispa *Dicladispa armigera*;; The Rice Leptispa Leptispa pygmaea;; The Gregarious Blue Beetle *Haltica cyanea* and the Spotted Leaf beetle Oides *affinis* are reported to attack rice plants. The Leaf Scraper *Callispa* sp. is a pest of coconut. The Sugarcane Hispid *Physodonta* cuspidata grub is a leaf miner and adults feed on sugarcane leaves. The Flea Beetles *Pagria* constatipennis and *Neculla pollinaria* are pests on sugarcane.

The Leaf Grub *Lema* sp. is a pest on cardamom. *Hoplosoma abdominalis; Basilepta fulvicorne; Hypeaxis albostriata; Pagria constatipennis* are pests of cashew feeding on the leaves. The Leaf Beetle *Monolepta longitarsus* another pest of cashew appears in large numbers during monsoon season and causes damage to tender leves and shoot. The Zinnia Flea Beetle *Monolepta khasiensis* feeds on flowers of zinnia. *M. signata* attack colocasia, while *M. longitarsus* attack cocoa plant. The following are reported as pests of sweet potato: *Aspidomorpha miliaris; Chirida sexnotata; Metriona circumdata* and *Oncocephala tuberculata*. The Yam Beetles *Galerucida bicolor* and *Lema lacordairei* are pests on Yam. The Pollu Beetle *Longitarsus nigripennis* is a pest on pepper, the grub feeding on berries while the adults on leaves. *Monolepta limbata; Metriona circumdata; Epistictia weisei; Hyperaxis fulrohirsuta* and *Aulacophora cruenta* are pests on cocoa feeding on leaves. *Apophylia Crotchi; Hoplasoma unicolor; Aulacophora parambikulamensis; A. niligiriensis; A. foveicollis; A. cincta; Periclitena vigorsi; Strobiderus nigripennis; Dercetis wallardia; D. travancorensis; Monolepta bifasciata; M. indica; M. analis; Cerophysa mandarensis; Mimastra costatipennis; Nonarthra dakshina; Philopona decemmaculata; Hyphasoma nilapita H. femoralis; Podontia congregata; Podagrica bowringi; Sebaethe pallidicincta*. The Powder Post Beetle *Sinoxylon* sp. Both the adults and grubs bore into the stem of cocoa plant. The stem Borer *Sphenoptera perotetti* attack groundnut. *Xyleborus fornicatus* bores into the stem of tea plant. *X. biporus* bores into the bark of rubber plant *X. morstatti* and *Xylosandrus compactus* infests coffee. Pest infestation is heavy during November-December. *Xyloborus parvulus* and *X. perforans* infest bark of coconut palm. *Crossotarsus externedentatus; C. squamulatus* and *Platypus quadricaudatus* are all timber and bark beetle. The grubs of Red Palm Weevil *Rhynchophorus ferrugineus* feed on stem of coconut and areca palms. The Bark Weevils *Diocalandra stignaticollis* is a pest on coconut and areca palms. Leaf Weevils *Myllocerus curvicornis* and *Indomias* sp. feed on leaves of coconut palm. *Myllocerus* sp. attack groundnut, lady's finger and drumstick. *Hypolixus truncatulus* grub bores into amaranthus plant. *Cylas formicarius* is a pest of sweet potato both in the field and in Stored condition.

Eugnathus curvus is a pest on pepper. *Prodioctes haematicus* grub bores into the rhizome of cardamom. *Sternochectes haematicus* grub bores into the rhisome of cardamom. *Sternochet magiferae* grub feeds on the contents of mango nut. *Deporaus (Eugnamptus) marginatus* is another pest of mango feeding on the leaves. *Rhynchoenus mangiferae* is a leaf miner attacking the leaves of mango. The other pests of mango are: the Leaf Weevils—*Myllocerus discolor; M. sabulosus; M. maculosus* and *Apoderus tranquebaricus. Mylloderus viridanus Amblyrhinus poricollis; Apion amplum; Aroderus marginatus;* and *A. trankuebaricus* are pests on cashew. *Ochvromera artocarpi* is a pest of jack, the grubs bore into tender buds and fruits. *Cosmopolites sordidus* grub bores into the rhizome of banana. *Lepropus oculatus; Crinorrhinus crassirostris* and *Rhynchites* sp. are weevils attacking leaves of cocoa. *Arecenua fasciculatus* grubs bore into berries of coffee plants. *Celolanguria curvipeds: Languriophasma discoidalis; Anadastus distinctus; A. ceylonicus; A. bifasciatus; Caenolanguria nilgirensis. Silvanus lewisi; S. difficilis.*

ORDER: HYMENOPTERA:

To this order belongs ants, wasps bees etc. These are mostly free-living may be phytophagous feeding on plants or predatory on other insects or may be parasitic on other insects in their larval stages (known technically as protelean parasites) as in the case of some of the wasps. Some of the wasps, because of their entomophagous parasitic nature as used as pest control agents. Ichneumon wasps are typical examples. Some of the hymenopterans possess strong poison and stinging apparatus. Their sting causes severe allergic manifestations in human beings which may even terminate in the death of the victim. *similis; X. wynaadensis; Acromia pinctata; Silsila fulvipes;* Charops brachypterum; C. bicolor *(hosts:)* Naranga aenescens, *Anomis flava, Pelopidas mathias, Psalis pennatula, Leucania loreyi, Spodoptera mauritia etc.) C. hersi (hosts: Herse* sp. which feed on *Colocasia antiquorum); Enicospilus dasuchirae (ex pupa of Psalis pennatula) E. atricornis; E. laqueatus;* E. nocturnus; E. abdominalis; E. nigripectus; E. xanthocephalus and E. pectiniclavae. Henicospilus rufus parasitise the Black Hairy Caterpillar of *Pericallia ricini* a moth pest of mango. *Apanteles targamae* parasitises *Andevidia peponis* a noctuid caterpillar pest of cucurbits *Camptothlipsis flavudus; Zelomorpha*

amplarga; Apanteles rincini and *Meteorus* sp. parasitise the Black Hairy Caterpillar of *Pericallia ricini*, and arctiid moth which is a pest of mango. *Elasmus ansmalaianus; E. binocellatus; E. brevicornis* parasitic on *Lygropia quaternalis* and *L. obrinusalis; E. indicoides; E. kodaianus; e. munnarus* and *E. valaparaianus. Liporrhopalum indicus*, a fig wasp found associated with Ficus gibbosa var *cuspidifera*, ; *Blastophaga malabarensis* another fig wasp found associated with Ficus callosa; *Platyscapa tjahela* (= *Blastophaga tjahela*)is a fig wasp found associated with *Ficus tjahela*; P. *arnottiana* a fig wasp associated with Ficus *arnottiana*; Sycorycteridea *keralensis* a fig wasp associated with Ficus *callosa*. The Fig Wasp *Sycoryctes callosa* and *Grasseiana callosa* are associated with *Ficus callosa*. The Fig Wasp *Philotrypesis breviventris* is associated with *Ficus gibbosa* var *cuspidifera*; *P. anguliceps* is associated with *Ficus religiosa*; the Fig *Wasps Philotrypomorpha indica, Sycoscapter arnottianus* and *Philosycella wiebesina* are associated with Ficus *arnottiana*. *Sycoscapteridea longipalpus* is associated with Ficus *exasperata*. *Brachymeria coxodentata, host unknown*. B. *lasus* attacks pupae of many lepidoptera. *B. hearseyi* var *xanthoterus*. Hosts of this chalcid wasp are Hypsiphyla robusta of family Pyralidae, Euploea core of family Nymphalidae and *Danais chrysippus* of family Danaidae. *B. nursei* parasitises *Simplica* robustalis of family Noctuidae. *B. koduvalliensis* attacks *Microplitis maculipennis* and *B. scutello-carinata* attacks tachinid pupae. The host of the chalcid *B medicine* is unknown. The chalcid *B. minuta* parasitises some diptera, lepidoptera and neuroptera. *B. fonscolombei* is a parasite on Blowflies and Muscoid Diptera. The hosts of *B.podagrica* and *B. bengalensis* are not known. *B.* amphissa parasitise *Earias* sp. *B.* margaroniae is parasitic on Diaphania *(Margaronia)* indica of family Pyralidae. *B.* carinata is parasitic on *Psychid* which is a pest of *Pithacolobium* sp. The hosts of *B. megaspila* and *B.excarinata* remain to discovered. *B. (Neobrachymeria) nosatoi* is a parasite of *Nephantis serinopa, Dioryctria splendidella* and *Evertria cristata*. *B. punctifronta, B. scrobatae, B. marginata* and *B.euploeae* are the other chalcids reported from Kerala. *Anagyrus longipennis parasitises Coccids. A. indicus* parasitises *Nipaecoccus* sp. *Ooencyrtus* sp. parasitises eggs of Epilachna Beetle *Epilachna vigintioctopunctata* belonging to Coccinellidae and is a pest of brinjal. *Gryon brachystigmatis;* G. *brevifunicularis*

and *G. malabaricus*. *Oecophylla smaragdina* does not cause any direct injury to mango tree but it is troublesome in distributing injurious aphids, mealy bugs and scales on the tree. *Aenictus wroughtoni; A. fergusoni; A. aitkenī: A. pachycerus; A. brevicornis; Lioponera longitarsus; Odontomachus haematodes; Drepanognathus saltator: Lobopelta dentilobis L. dalyi: Platythyrea wroughtoni; Diacamma ceylonense; D. sculptum; Ectomomyrmex annamitus; E. Leeuwenhoeki; Bothroponera rufipes; B. tesserinodae; Sima nigra; S. fergusoni; S. longiceps; Cremastogaster travancorensis; C. rogenhoferi; C. flava; Phidologiton diversus; P. affinis; Meranoplus rothneyi; Tetramorium ferfusoni; T. inglebyi; Lophomyrmex quadrispinosus; Monomorium minutum; Phidole spathifera; P. fergusoni; Messon barbarus; Holcomyrmex scabriceps; Acantholeps fergusoni; Plagiolepis jerdoni; Colobopsis stricta; Camponotus rufoglaucus; Polyrhachis gracilior; P. mayri; P. thrinax; P. clypeata Dorylus orientalis* damages seedlings of coconut. *Solenopsis geminata* bores into roots, buds and terminal shoots of coconut palm. *Eumenes dimidiatipennis; E. flavopicta; Rhynchium argentatum Vespa basalis; Scolia aureipennis; S. indica; Salius fulgidipennis; Pompilus multipictus; Ammophila erythrocephala; gorytes alipes; Anthidium lachrymosum; Coelioxys minutus; Crocisa emarginata Xylocopa latipes; X. amethystina: X. bryorum. Apis mellifera; A. indica* and *A. dorsata* are domesticated bees for collection of honey. Leaf Cutting Bee *Megachile anthracina* and *M. disjuncta*. These bees cut circular pieces from leaves of roses.

ORDER: LEPIDOPTERA:

To this order belongs butterflies and moths. Caterpillars (immature stages) of these are plant feeders. Many of them are pests of crops. Adults of some species do not feed at all and those which feed, suck nectar from flowers with their specialised proboscis. Various species belonging to about 36 families have been reported from Kerala which contains an impressive list of crop pests.

Batachedra arenosella: The Spathe Borer, is a pest of coconut and areca palm. Caterpillar feeds on flowers. *Coconymphs irriarcha* is a pest of coconut, caterpillar feeding on leaves. The Root Borer *Hilarographa caminodes* is a pest of Cardamom. Caterpillar bores into the root. Bark Miner *Acrocercops zygonoma* is a pest of mango. The caterpillar bores through tender shoot and bark. The Leaf Miner *A. syngramma* is a pest

of mango and cashew. Caterpillar mines leaves. The Leaf Roller *Gracillaria theivora* pest of Tea plant. Caterpillar mines leaves. Flower Caterpillar *Pyroderces* sp. Pest of araca palm feeds on floral parts. The Lablab Leaf Miner *Cosmopteryx phaeogastra*, pest of pulses. Caterpillar is a leaf minar. The Ground nut Leaf Miner *Biloba (Stomopteryx phaeogasytra*, is a pest of ground nut. Caterpillar feeds on leaves. The Bud Borer *Phthorimoea blapsigona* is a pest of Brinjal. Caterpillar bores into tender buds. The Leaf Folder *Brachmia convolvuii* and the Leaf Caterpillar *Onebala lamprostoma* are pests of sweet potato, feeding on leaves. The Shoot Borers *Anarsia epotias* and *Chelaria haligramma* are pests of cashew. Caterpillars attack tender shoot, inflorescence and leaves. The Leaf Folder *Homona* sp. Caterpillar feeds on leaves of cardamom. The Flush Worm *Homona coffearia* is a pest of tea and coffee plants. Caterpillar feeds on leaves. Shoot Borer *Laspeyresia hemidoxa* is a pest of pepper. Caterpillar bores into terminal shoot. Caterpillar is parasitised by *Apanteles* sp. *Euderus* sp. and *Goniozus* sp. The Leaf Folder Flush Worm *Laspeyresia leucostoma* caterpillar feeds on leaves of tea plant. Shoot Borer *Platypeplus (Argyroploce) aprobola* is a pest of mango. Caterpillar attacks epidermis of stem. The Sunhemp Stem Borer *Enarmonia (Laspeyresi) tricentra* is a pest of the green manure plant Sunhemp. Caterpillar bores into the stem and feed on internal tissues. The Plume Moth *Sphenarches caffer*, caterpillar of this moth is a serious pest of bottle gourd causing damage to foliage. The plume Moth *Exelastes stomosa*. Caterpillar feeds on seeds of pulses in pods. The Rice Stem Borer *Scirpophaga Tryporyza) incertulas* and the White Borer *S. innotata* are pests of rice plant. Caterpillars bore into the stem and feed on the internal tissues. The Top Shoot Borer *S. nivella* is a pest of sugar cane. Attack of caterpillar causes dead-heart in young plants and bunchy top in older plants. The Rice Leaf Roller *Cnaphalocrocis medinalis* is a pest of rice plant and all stages of rice plants are attacked. The Rice Case Worm *Nymphula depunctalis* is a pest of rice plant. Caterpillar feeds on leaves. Several weeds act as alternate hosts. The Nut Borer *Tirathaba* sp. is a pest of coconut. Caterpillar bores into the nut. The Leaf and Pod Borer *Antigastra catalaunalis* is a pest of sesamum. Caterpillar feeds on leaves, flowers and

pods. The Leaf Roller *Sylepta derogata* is a pest of lady's finger. Caterpillar feeds on the leaves. *S. aurantiacallis* is a pest of cashew. The caterpillar attacks leaves. The Balsam Leaf Caterpillar *S. textalis*. Caterpillar feeds on leaves of balsam. The Shoot and Fruit Borer *Leucinodes orbonalis* is a pest of brinjal. Caterpillar attacks shoot and fruit. The Stem Borer *Euzophera perticella* and the Leaf Webber *Psara bipunctalis* are both pests of brinjal feeding on leaves. The latter is a pest of amaranthus also. The Leaf Caterpillar *Noorda blitealis*; the Bud Borer *N. moringae* and the Leaf Webber *Protrigonia zizanialis* are pests of drum stick. Caterpillars feed on leaves. *P. zizanialis* is commonly seen during February—June. The Pumpkin Caterpillar *Marganonia indica*, a pest of cucurbits. Caterpillar feeds on leaves. The Shoot Borer *M. Caesalis* is a pest of jack. Caterpillar bores into tender shoot. The Leaf Folder *M. unionalis* is a pest of jasmine. Caterpillar attack leaves and flower buds. The Amaranthus Leaf Webber *Hymenia recurvalis* and the Leaf Caterpillar *Lamprosema diamenalis* are pests of amaranthus. Caterpillar feeds on leaves. *L. indicata* is a pest of chrysanthemum. Caterpillar feeds on tender leaves. The Wine Borer *Omphisa anastomosalis* and the Leaf Caterpillar *Tabidia aculealis* and the Leaf Caterpillar *Tabidia aculealis* are pests of sweet potato. The Leaf Folder *Pycnarmon cribrata*. Caterpillar feeds on the leaves of coleus. The Tulsi Caterpillar *P. caberalis*. Caterpillar feeds on leaves of Tulsi plant. *Phostria piasusalis*, Caterpillar feeds on leaves of coleus. The Stem and Capsule Borer *Dichocrocis punctiferalis* is a pest of cardamom. guava, ginger and turmeric. The Leaf Webber *Ereboenis saturata*. Caterpillar feeds on leaves of tea plant. The Spadix Borer *Tirathaba mundella* is a pest of areca palm. caterpillar feeding on inflorescence. The Spotted Pod Borer *Maruca testulalis*; *the Spiny Pod Borer Etiella zinckenella* and the Leaf Roller *Nacoleia vulgalis* are pests of pulses. Caterpillars attack seeds, pods and tender stem. The Shoot Webber *Orthaga exvinacea* is a pest of mango and cashew. Caterpillar feeds on leaves. The Inflorescence Caterpillar *Eatholix flavibasalis* is a pest of mango. Caterpillar feeds on flowers. The Leaf and Blossom Webber Macalla moncusalis and *Thylocoptila paurosema* are pests of cashew. The Leaf Web Worms *Nausinoe neptis* and *N. geometralis* and the Bud Caterpillars *Hendecasis*

duplifascialis and *Elasmopalpus iasminophagus* are pests of jasmine. The Shoe Flower Caterpillar *Crocallis* sp. is a pest of shoe flower. Caterpillar feeds on leaves of Shoe flower. The Caterpillars of *Glyphodes glauculalis* feed on leaves of the garden plant Tabernimontana. In addition to these moths the following have been recorded from Kerala (vide Fauna of British India) *Crambus anticellus; Charltona cervinella; C. inconspicuella; Tyndis hypotialis; Glyphodes marginate; G. nilgirica; Pygospila costiflexalis* and *Ischnurges gratiosalis.* The Malayan Borer *Chilo polychrysus.* Caterpillar of this moth, a pest of rice plant feds on stem tissue. The Shoot Borer *C. infuscatellus* and the Internode Borer *Proceras indicus* are both pests of sugarcane. The caterpillars of these bore into the stem. The Bag Worm *Acanthopsyche bipars* feeds on the leaves of cardamom. Caterpillars are seen during June to August. The Case Worm *Clania crameri* is a pest of tea plant. Caterpillar attacks leaves and bark. The Basket Worm *Acanthopsyche snelleri* is a pest of rubber. The Bag Worms *Manatha albipes, Cryptophelia* sp. and *Thyridopteryx* sp. are pests on areca palm. The Bag Worm *Pteroma* sp. is a pest of pomegranate. The Bag Worms *Acanthopsyche minima* and *Kophene cuprea* are pests of banana. The Black Hairy Caterpillar *Peicallia ricini* is a pest of drumstick; Sweet Potato; pulses; banana; yam and cocoa. Caterpillar attacks leaves. The Hairy Caterpillars Diacrisia obliqua and *Estigmene lactinea* feed on the leaves of moringa. *Alphaea biguttata* seen from June to December is a pest, but not a serious one, of cardamom. The Hairy Caterpillars *D. obliqua* and *P. ricini* attack pulses and sesamum also, feeding on their leaves. The Hairy Caterpillars *Asura ruptofascia; Chelama fasciata* and *C. analis* are pests of mango, feeding on flowers. The Black Hairy Caterpillar *Estigmene lactinea*, feeds on the leaves of cashew. The Hairy Caterpillars of *Asura ila* and *Creatonotus gangis* feed on leaves of banana. The Sun—hemp Hairy Caterpillar *Utetheisa lotrix* feeds on leaves and seeds of sun—hemp. The Hairy Caterpillars of *D. obliqua; P. ricini* and *Amsacta gangis* feed on leaves of cocoa. The Red Hairy Caterpillar *Amsacta* albistriga is a polyphagous one. It feeds on the leaves of groundnut also. The Rice Swarming Caterpillar *Spodoptera mauriritia* feeds on leaves of rice plant and seen abundantly during October - December. The caterpillars of *S. litura* feed

on the leaves of groundnut; pulses; banana; yam; amaranthus; colocasia; rose and cocoa. The Ear – Cutting Caterpillar The Climbing Cut Worm *Mythimna separata* feeds on the ripening ear – heads, of rice plant. The Pink Borer *Sesamia inferens*; the Rice Semilooper *Mocis frugalis* and the Rice Green Caterpillar *Naranga diffusa* are all pests of rice infesting the leaves. The caterpillars of *Plusia signata* feed on leaves of groundnut and sesamum. The caterpillars of *Heliothis armiger* feed on leaves of groundnut and pulses. The Shot and Fruit Borer *Earias vitella (fabia)*; the Green Semilooper *Anomis flava and the* Semilooper Caterpillar *Acontia groellsi are pests of lady's finger.* The Leaf Folder *Antoba (Eublemma) olivacea*; the Leaf Caterpillar *Selepa docilis* are pests of brinjal. The Leaf Noctuid *S. celtis*, infests leaves of cashew. The Snake Gourd Caterpillar *Anadevidia peponis (Plusia peponis)* feeds on the leaves of cucurbits. The Leaf *Caterpillar Cretonia (Swinhoea) vegeta* is a pest of sweet potato. The Cut Worm *Arcilasia plagiata* feeds on the tender leaves of cardamom during January – march. The Pod Borer *Adisura atkinsoni*; the Green Caterpillar *Anticarsia irrorata* and the flower and Pod Borer *Polyorycta dimidialis* are all pests of pulses. The caterpillars of *Eublemma angulifera*; *E. abrupta* and *E. brachygonia* are pests of mango. The Shoot and Flower Caterpillar *Chlumetia transversa* attack terminal shoot and flowers of mango. The Flush Caterpillar *Bombotelia jocosat* feeds on leaves of mango. The caterpillars of *Nanaguna breviuscula* and *Lophothripa vitea* feed on leaves of mango. The Fruit Moth *Anua coronata* suck juice of ripe fruit of banana. The caterpillar feeds on the leaves of weeds and citrus. The Fruit Moth *Othreis fullonica*. The adult moth suck juice of ripe fruits of banana and citrus. The Fruit Sucker Moth *O. materna*; and *O. ancilla* and *Lasoptera honesta* suck juice from fruits of citrus. The Lily Caterpillar *Polytela gloriosae* feeds on lily leaves. The Semilooper *Achoea janata* caterpillars feed on the leaves of cocoa and Pomegranate. In addition to these pests other noctuid moths recorded from Kerala (vide Fauna of British India) are: *Zethes pictipennis*; *Capnodes ceylonica*; *catada vagalis*; *Hypena ineffectalis*; *Leucania exempta*; *L. proleuca*; *Anuga constricta*; *Sypna punctosa*; *Agonista reducens*; The Nut Borer *Cyclodes omma*, caterpillar of which bores into tender coconut: *Ophiusa submira*; *O. amygdalis*; *O. trapezium*; *Dordura aliena*;

cashew and Palijath. The caterpillar *Lenodera vittata* is pest of cardamom and is a defoliator. *Attacus atlas* and *Cricula trifenestrata* are reported as pests of cardamom and cashew and pepper respecively. Caterpillars of both feed on leaves and the former is a defoliator. The Leaf Miner *Phyllocnistis citrella* causes mines on the leaves of citrus. *Euchromia polymena; Decetia subobcurata; Eusemia latimargo.* The Caterpillar of *Eterusia virecens* attacks leaves of tea plant. *Cyclosia australinda; Hhantopterus caudatus; Acropteris obliquaria.* The Coconut Caterillar *Nephantis serinopa* attacks leaves of coconut and areca palms. April and June are the two peak periods of attack. The lairy Caterpillar of *Euchromia polymena* feeds on leaves of swet potato. *Eupterote cardamomi, E. canarica, E. testacea* and *E. fabia* are pests of cardamom. Eupterote mollifera attack moring, caterpillars feeding on leves and bark. The Hairy Caterpilars of *Argina cribraria* and *A. syringa defoliates* green manureplants like sunhemp. The Red Borer *Zeuzera coffeae* attack tea plants, coffee plants, pomegranate and cocoa. The .gathi stem Borer *Azygophleps scalaris* attacks green manureplants. Two species of *Indarbela* reported are *I. theivora* and *I tetraonis*. Caterpillars of the former attack tea plants while tose of the latter attack citrus, cashew, guava and pomegranate The Slug Caterpillars of *Contheyla rotunda* feed on leaves of te plants. Caterpillars of *Thosea cervina* feed on leaves of tea plant. The Slug Caterpillars of *T. cotesi* feed on cashew leaves The Slug Caterpillars of *Latoia lepida* are pests of mango, cashw, coconut, rose, coffee, banana and pomegranate feeding on leves. The Slug caterpillars of Latoia lepida are pests of mano, cashew, coconut, rose, coffee, banana and pomegranate feding on leaves. The Slug caterpillars of *Miresa decedens* feedon the leaves of banana. The Jelly Grubs *Belippa laleana* and *Nemeta (Belippa) lohor* and the Slub Caterpillar *Microlimax sp.* feed on leaves of banana. *B. laleana* is reported to attack coffeeplants also. The Slug Caterpillars of *Macroplectra nararia* are pets of coconut and coffee. The Glassy Tiger *Danais aglea* requents hills about 1600 m. elevation. The Darkblue Tiger *D. melissa* frequents hills abut 3200 m. elevation. The Common Tiger *D. plexippus* is very common in the regions of heavy rain fall. The Plain Tiger *D. chrysippus* is one of the commonest butterflies of India the caterpillar of which feeds on

Calotropis. The Common Indian Crow *Euploea core*, a very common butterfly. The Double—branded Black Crow *E. coreta* frequents hills and plains. The Brown King Crow, *E. crassa* frequents the wet jungles of the hills. The Nilgiri Tiger *Danais nilgiriensis* common at 1500 m. elevation in the hills and in open cultivated country. The Blue Tiger *D. limniace* frequents both plains and hills. (Family, Satyridae). The White—bar Bush Brown *Mycalesis anaxias* frequents evergreen forests. The Common Bush Brown *M. perseus* Common in wooded parts. The Dark—brand Bush Brown *M. mineus* frequents plains and hills. The Small Long—brand Bush Brown *M. igilia* found at elevations of 1000 m. The Long—brand Bush Brown *M. visala*. The pale—brand Bush Brown *M. khasia* commonly found in the jungles. The Red—disc Bush Brown *M. oculus* frequents hilly areas. The Glad—eye Bush Brown *M. patnia* frequents jungles. The Nigger *Orsotrioena medus mandata*. The Dark Evening Brown *Melanitis phedima varaha*. The Caterpillars of *M. leda ismene* are pests of rice plants. The Travancore Evening Brown *Parantirrhoea marshalli* frequents hills at elevations of 670 m. The Common Palmfly *Elymnias hypermnestra*. The Leaf Caterpillar of *E. caudata* feed on foliage of areca palm. The Common Tree Brown *Letha rohria* race *nilgiriensis* frequents plains and hills. The Nilgiri Four—ring *Ypthima chenui* frequents plains and hills. The Nilgiri Four—ring *Ypthima chenui* frequents hills. The Plain Four—ring *Y. ypthimoides* confined to the higher ranges of hills. Caterpillars feed on *Callerbia ypthimoides*. The White Four—ring *Y. ceylonica* frequents hills. The Common Four—ring *Y. hubneri* race *ceylonica* frequents open hill country and thick forests. The Baby Five—ring *Y. philomela* race *indecora* frequents grassy hills tops at 1160 m. elevations. The Common Five—ring *Y. baldus* frequents plains and hills upto 2300 m. The Palmking *Amathusia phidippus*. The southern Duffer *Discophora lepida frequents bamboo jungles. The Tawny* Rajah *Charaxes polyxena* is confined to jungles. Caterpillar feeds on *Tamarindus indica* and *Saccopetalum tomentosum*. The Black Rajah *C. fabius*. Caterpillars feed on *Tamarindus indica*. The Blue Nawab *Eriboea schreiberi*.The Black Prince *Apatura parisatis* frequents evergreen regions upto 200 m. elevation. Food plants of the caterpillar are : *Celtis tetrandra* and *C. lycodoxylon* belonging to family Urticaceae. The Pinted

Couresan *Euripus consimilis.* Food Plant of the caterpillar is *Trema orientalis* belonging to family Urticaceae. The Grey Count *Euthalia lepidea.* Caterpillars feed on *Melastoma malabaricum* belonging to ther family Melastomacea and *Careya arborea* of the family Myrtaceae. The Baron *E. Garuda.* Caterpillar feeds on *Loranthus sp.* The Clipper *Parthenos sylvia* is confined to jungles and the caterpillars feed on *Modecca* sp. The Commander *Limenitis procris.* Caterpillar feed on *Mussaenda frondosa.* The Staff Sergeant *Pantoporia selenophora* frequents evergreen forests at 670—1600 m. elevation and caterpillar feeds on *Adina cordifolia* belonging to Rubiaceae. The Blackvein Sergeant *P. ranga* frequents evergreen regions at elevations upto 1600 m. and caterpillars feed on *Olea dioica* and *Linociera malabarica* belonging to Oleaceae. The Sullied Sailor *Neptis soma kallaura* frequents hilly areas. The Clear Sailor *N. nandina hampsoni* frequent hills. The Yellow jack Sailor *N. viraja.* The common Lascar *N. hordonia* frequents thick jungles at low elevations. The Chest-nut-streaked Sailor *Neptis jumbah* frequents low country and hills upto 1000 m. The Common Map *Cyrestis thyodamas* frequents hilly jungles and plains. Caterpillar feeds on figs. The Great Eggfly *Hypolimnas bolina* frequents hillsit celevations of 1600 m. Food plants of the caterpillar are those belonging to the family Urticaceae. . The Danaid Eggfly *H. misippus.* Caterpillar feeds on *Portulaca oleracea* belonging to family Portulacaceae. The Blue Oakleaf *Kallima philarchus* frequents hilly areas with thick forests. The Lemon Pansy *Precis lemonias* frequents jungle areas but are also found in the plains. The Indian Red Admiral *Venessa indica* frequents forest, open country and Gardens nearby. The Blue Admiral *V. canace* frequents wooded country in hilly areas. The Indian Fritillary *Argynnis hyperbius* race *castetsi* keeps to open country, forest glades, gardens etc. at 2000 m. elevations. The Common Leopard *Atella phalantha* frequents edges of jungles on the plains. Plants belonging to Bixaceae are the food plants of the caterpillar. The Small. Leopard *A. alcippe.* Food plants of the caterpillar belong to family violaceae. The Tamil Yeoman *Cirrochroathais* frequents evergreen regions of the hills. Food plants of the caterpillar belong to the family Bixaceae. The Tamil Lacewing *Cethosia nietheri* frequents foothills. The Common Beak *Libythea lepita.*

The Banded Blue Pierrot *Castalius ethion* is confined to thick jungles. The Malayan *Megisba malaya* race *thwaitesi* frequents forests. Food plants of the caterpillar belong to family sapindaceae. The Flower and Pod Borer *Lampides elpis* caterpillars attack pods and flowers of cardamom. The Dingy Lineblue *Nacaduba dana* frequents plains and hills upto 2800 m. The Indian Sunbeam *Curetis thetis* var. *arcuata* infests plants belonging to families *Leguminosae* and *Meliaceae*. The Bright Sunbeam *C. bulis* and the Toothed Sunbeam *C. dentata* frequent hilly areas. The Manytailed Oakblue *Thaduka multicaudata*, caterpillars feed on plants belonging Euphorbiaceae. The Kanara Oakblue *Amblypodia canarica*. The Yam fly *Loxura atymnus* attacks yams. The Red Spot *Zesius chrysomallus* frequents jungles. The Common Onyx *Horaga onyx* frequent hilly country. The Common Tinsel *Catapoecilma elegans*. The fobd plant of the caterpillar is *Terminalia paniculata*. The Common Gauva Blue *Virachola isocrates* is a pest of pomegranate and guava. Caterpillar bores into fruits. The Common Bird-wing Troides belena frequents jungles. Food plants of the caterpillar belong to family Aristolochiaceae. The Ceylon Rose *Trosjophon* frequents jungles at 350 — 1000 m. elevation. The Paris Peacock *Papilio paris* race *tamilana* frequents evergreen regions. The Common Banded Peacock *P. crino*. The Malabar Banded Peacock *P. buddha* frequents jungle areas. Food plant of the caterpillar belong to Rutaceae. The Malabar Raven *P. dravidarum* frequents heavy jungles between 330 - - 1000 m. elevations. The Red Helen *P. helenus* race *daksha* inhabits evergreen jungles. Commonly found throughout the year. The Citrus Butterfly *P. demoleus* swarms are found in gardens after monsoon. Caterpillar feeds on citrus trees and is a defoliator. The Tailed Jay *P. agamemnon* (Zetides agamemnon). The caterpillars are pests on champaka, asoka, anona, etc. The Spot Sword-tail *P. antiphates* is confined to the wer evergreen jungles at low elevations. The Common Jezabel *Delias eucharis* frequents low country and hills upto 1000 m. Caterpillar feeds on *Loranthus*. The Pioneer Belenois mesentina frequents open country at elevations of 670-1300 m. Caterpillar feeds on plants belonging to family Capparidaceae. The Plain Puffin *Appias indra* frequents both forest and open country. The Common Albatross *A. albine* frequently hilly

regions. The Inland Cabbage White *Pieris canidia* frequents hilly areas. The Agathi Butterfly *Catopsilia pyranthe*. Caterpillar feeds on leaves of Agathi. The plain Orange Tip *Colotis eucharis*. The Dark Wanderer *Parenonia ceylanica* frequents thick jungle regions. The Common Grass Yellow Agathi Butterfly *Terias hecabe*. Caterpillar feeds on leaves of agathi and other green manure plants and is a defoliator. The Indian Palm Bob *Suastus gremius* is a pest of coconut. The caterpillar rolls leaves and feeds on them. The Vindhyan Bob *Arnetta vindhiana*. The Giant Red-eye Gangara thyrsis. Caterpillar rolls leaves of palm and feeds on them. The Dingy Scrub Hopper Aeromachus dubius frequents hilly areas at 1525-- 1980 m. elevation. The Pigmy Scrub Hopper *A. pygmaeus* frequents hilly areas upto 762 m. elevation. The Ceylon *Ace Halpe egena* (H.*homolea)*.The Hedge Hopper *Baracus vittatus* frequents hilly areas. The Kanara Swift *Baoris canaraica* (--*Caltoris canaraica)*. The Contiguous Swift *B. contigua (Polytrema lubricans)*. The grass Demon Skipper Butterfly Leaf Roller *Udaspes folus* is a pest of ginger and turmeric. The caterpillar is a defoliator. These are seen during August and October. The Cane Skipper *Telicota augias* is a pest of sugarcane. The Rice Skipper *Peolaopidas mathias* and *Prnara colaca* are pests of rice plant. Caterpillars are defoliators. The Skipper Butterfly *Plesioneura alysos* is a pest of cardamom.

Order : Diptera :

This order includes mosquitoes, house flies, eye flies etc. Adults are oten disease transmitters (vectors) like , for example, mosquitoes which transmit malaria, filariasis, house flies which transmit diseases like Cholera. The larvae frequently cause damage to vegetables and domestic animals. The larvae of Warble and Bot flies for example enter into the gut of horses, cattle and sheep and migrates thence to nostrils and skin causing damage to body tissues. Several species belonging to at least 12 families have been recorded from Kerala. Many more are undoubtedly awaiting further surveys.

Styringomyia pentachaeta; Toxorhina sparsiseta; Nephrotoma bellula; Dolichopeza seticristata; Hexatoma, aterrima; H. elengatissima; H. rufiventris; Molophilus inconspicus; Styringo-

myia flava. The maggots of the Gall Fly *Asphondylia sesami* eat flowers and buds of Sesamum. (Maggots pf the Gall Fly *Lasiopterafalcata* feed on the stem of bittergourd and cause galls. Maggots of the berry Gall Midge *Cecidomyia malabarensis* attack berries stalks and shoots of pepper plant The Root Gall Maggot *Hallomyia cardamomi* bore into the exposed roots of cardamom. The maggots of the Shoot Midge *Erosomyia indica* tunnel through the shoots, petioles and inflorescence of Mango. Maggots of the Bud Midge *Procystiphora mangiferae* feed on flower of Mango. According to the report of Iyengar (1938) the following species of mosquitoes have been recorded from Kerala : *Megarhinus splendens; Harpagomyia genurostris; Uranotaenia alboannulata; U. testacea; U. luteola; U. strickland; Orthopodomya anopheloides* var *maculata; O. flavithorax; Ficalbia (Mimomyia) chamberlaini; F. (M) hybrida; F. (etorleptiomyia) luzonensis; F. (F.). minima; Mansonia (Mansonioides) annulifera; M. (M.). /uniformis; M. (M.). indiana; Aedeomyia venustipes; Aedes (Finlaya)* Khazani; *A.(F). pseudotaeniatus; A. (F). Greeni* var. *kanaranus; A.(F). chrysolineatus; A.(F). albolateralis; A.(F). niveus; A. (Stegomyia) albopictus; A.(S). vittatus; A. (Aedimorphus) jamesi; A.(A). pipersalatus; A. (Diceromyia) iyengari; A. (Aedes) indicus; A. aegypti; Heizmannia viridis; Amrigeres (Armigeres) obturbans; A.(A). theobaldi; A.(A). aureolineatus; A. (Leicesterial) digitatus; A. (L). omissus; Culex (Lutzia) fuscanus; A. (neoculex) brevipalpis; C. (Mochthogenes) pulvialis; C.(M). malayi, C. (lophoceratomyia) minutissimus; C. (L). minor; C.(L). uniformis; C. (Culticiomyia) pallidothorax; C. (Culex) biotaeniorhynchus; C.(C). sitiens;c.(C).vishnui;C.(C)tritaeniorhynchus; C.(C). gelidus; C.(C). mimulus; C.(C). mimeticus, C.(C). nilgiricus; C.(C).fatigans C (C). fuscocephalus: Anopheles (Anopheles) aitkeni; A.(A). insulaeflorum; A.(A). annandalei* var. *interruptus; A. (A). insulaeflorum; A.(A). annandalei* var. *interruptus; A.(A). hyrcanus* var. *nigerrimums; A.(A). barbirostrits; A. (myzomyia) leucosphyrus; A.(M). tessellatus; A.(M). culicifacies; A.(M). fluviatilis; A.(M) varuna; A.(M). aconitus; A.(M). jayporiensis; A.(M). j.* var. *candidiensis; A.(M). subpictus; A(M). vagus; A.(M). maculatus; A.(M). karwari; A.(M).jasmesi; A.(M). splendidus; A.(M). annularis; A.(M). philippinensis* and *A. (M). pallidus*. This probably is the only exhaustive survey of mosquitoes made in Kerala.

Paragus indicus; P. rufiventris; Melanostoma univittatum; Baccha nubilipennis; Megaspis crassus; M. argyrocephalus; Xylota bistriata; Eumerus; nicobarensis; Milesia sexmaculata; Pipunculus chalybeus; P. nitens; Stylogaster orientalis; Dacus trilineatus Accnthonevra imparata; A. inermis; Phaeospilodes bambusae; Carpophthorella scutellomaculata; Indaciura basivitta; Dacus longistylus;. The larvae of the Melon Fly *Dacus (Strumeta) cucurbitae* bore into the fruits of cucurbits. The maggots of the Fruit Fly *D. dorsalis* feed on the pulp of ripening fruits of mango. *Tephritis fossatus*. The Fruit Fly *Drosophila* sp. is commonly found in houses where ripe fruits, decaying vegetables etc., are kept. Larvae of Agromyza sahyadriae mine leaves of grasses. The larvae of Japanagromyza indica mine leaves of *Pueraria phaseolides* (Leguminosae). *J. vancheri. Melanagromyza atomella* is widely distributed on the plains and feeds on a variety of plants. Larvae of these tunnel through the epidermis of leaves. Peak infestation period is July—October. *M. eravensis*. The larvae of *M. metallica* are internal stem feeders of certain plants belonging to the family Compositae. The larvae of *M. thekadi* make upper epidermal mines on its host plant. Larvae of *M. obtusa*, according to Nair (1978) feed on pulses. The larvae of *M. phaseoli* bore into the stems of leguminose plants. Larvae of *M. hibisci* mine into the leaves and tender stem of Lady's Finger (*Hibiscus esculantis*). *M. theae* is reported to be widely distributed in tea estates infesting tea plants. One other species of Melanagromyza reported from Kerala is reported to be widely distributed in tea estates infesting tea plants. One other species of Melanagromyza reported from Kerala is *M. padmanabhi*. Larvae of *Ophiomyia lantanae* feed on thalamic tissue of *Lantana camara*. The other species of Ophiomyia reported from Kerala is *O. recticulipennis*. Six species of the genus Cerodontha have been described. the larvae of all of these attack leaves of grasses: *Cerodontha (Cerodontha) versicolor; C. (Dizygomyza) pathanapuramensis; C. (Icteromyza) periyari; C. (Poemyza) kumiliensis; C. (P) walarai and C. (butomomyza) caricivora*. The other reports of agromyzids from Kerala are: *Phytobia ipeli; Liriomyza bharati; L. flaveola;* Phytagromyza *keralaensis; Paraphytomyza sabarii; Pseudonapomyza azizi; P. domestica*. Nair (1978) reports the occurrence of Phytomyza horticola in Kerala, the larvae of which mine the

leaves of certain pulses and ornamental plants. Two species of Fruitflies reported from Kerala are *Siphunculina funicola* and *S. ulceria*. *Chalcidomyia atricornis* and *Formosina flavipes*. The last two species bore into and feed within the rhizome of Ginger. *Musca domestica*, the common housefly is a serious menace to human beings. The larvae of these breed in dung and manure heaps. The species of Fleshflies reported from Kerala are: *Parasarcophaga (Parasarcophaga) knabi; P. (P) albiceps; Seniorwhitea krameri* and *Iranihindia martellata* Nycteribids and Hippoboscids are blood sucking dipterans. The former infests bats and have extreme modifications for parasitic adaptation. The Houseflies or hippoboscids attack birds and mammals. These are commonly found on cattle, dog etc. A survey of these in Kerala is yet to be organised.

Order: Siphonaptera:

This order includes fleas which are wingless insects with laterally flattened body, piercing and sucking type of mouth parts and long legs adapted for jumping. The adults of these insects are ectoparasites on birds and mammals and feed on the blood of their hosts. Unlike mosquitoes, both the males and females of fleas are blood suckers. The larvae are, however, free—living detritus—feeders and normally found in the nests or the sleeping place of the hosts of the adults. Certain species of fleas have been incriminated as Vectors (disease transmitters) of diseases like plague and some of them, like the cat flea, are domestic pests. Elaborate survey of this group in Kerala is wanting, however, so far known, species belonging to five families have been recorded. *Tunga penetrans*, the female of which is a permanent parasite forming a cyst in the place of attachment. This species have been reported as parasites of human beings. *Echidophaga gallinacea* is another example of permanent parasite where female remains attached to the body of the host. These infest fowls, cats, dogs, Lepus, Herpests etc. *Ctenocephalides felis felis* and *Ct. orientis* infests cats, dogs and also attacks human beings. This is a very familiar domestic pest where cats and dogs are found. The three species of the genus Xenopsylla reported are *X. cheopis; X. brasiliensis* and *X. astia*. Of these the first one is a notorious vector of plague. These are normally found on rats and in the

absence of rats they readily attack human beings. The three species of Stivalius reported from rodents like **Rattus rattus**, the house rat, *Mus* sp. the field and house mouse, squirrels like *Funambulus palmarum* and shrews like *Suncus* sp. are *S. ahalae*; *S. aporus* and *S. ferinus*. *Nosopsyllus nilgiriensis*; *Leptopsylla (Leptopsylla) segnis* and *Peromyscopsylla himalaica* are other flea parasites of rats and mice.

Order: *Collembola*:

Popularly known as Springtails. These are small insects with an abdominal jumping organ, abundantly seen in moist leaf mold, soil, rotten wood etc. All the species reported here were collected from soil and litter from plains, forest and tea field areas. *Paratullbergia indica*; *P. salmoni*; *P. trivandrana*; *Prabhergia nayari*; *Mesaphorura intermedia*; *M. salmoni*; *M. dubia*; *Stenaphorura selgae*; *Protaphorura ghatensis*; *P. cryptopyga*; *Xenylla reducta*; *Hypogastura communis principallis*; *Willemia delamarei*; *W. setonychia*; *Brachystomella terrafolia*; *Odontella trispina macronychia*; *Friesea mirabilis*; *F. yosii*; *Lobella cassagnaui*; *Megachorutes ponmudiensis*; *Pseudachorutes periyarensis*; *Arlesia pillaii*; *Gnatholonche corallina*; *Folsomides parvus*; *F. exiguus*; *F. stachi*; *Isotomodes dagamaea*; *Subisotoma canituda*; *Folsomia baijali*; *Ballistrura bengalensis*; *Isotomurus balteatus*; *Isotomiella minor*; *Isotomina interrupta*; *I. thermophila*; *Lepidocyrtoides quatuordecimocellata*; *Pseudosinella pettersenl*; *Lepidocyrtus*; *orientalis*; *Heteromuricus cercifer*; *Dicranocentrus spinosus*; *Drepanura falcifera*; *Alloscopus tetracantha*; *A. anoculatus*; *Indoscopus spinosus*; *I. aspinosus*; *Cyphoderopsis sexocellata*; *C. decemoculata*; *Cyphoderus javanus*; *Aphysa ceylonica*; *A. nigerrima*; *A. sudindica*; *A. travancorica*; *A. vestita*; *Microparonella duodecimoculata*; *Salina celebensis*; *S. quattuorfasciata*; *S. tricolor*; *Megalothorax minimus*; *Neelus murinus*; *Sminthurides velli*; *Sphaeridia biniserrata*; *S. gladiolifer indicus*; *S. indica*; *S. pumilis*; *Collophora remanei*; *Pararrhopalites anops*; *Sminthurinus trinotatus*; *Sphyrotheca gangetica*; *S. intermedia*; *S. yosii*; *Lipothrix submagnificata*; *Ptenothrix Keralae*; *P. serratus*; *Deuterosminthurus spathaceus*; *Lipothrix indicus* and *Dicyrtomina (Calvatomina) trivandrana*.

Order: *Protura*:

Minutex. wingless, blind insects with piercing and sucking mouth parts. These insects live in damp humus and soil and feed on decayed organic matter. ***Eosentomon validum***; Gracilentulus kenyanus; ***Berberentulus morikawai***; ***Australentulus orientalis*** and ***Aanoseki***.

CLASS ARACHNIDA

To this class belongs familiar forms like spiders, scorpions, mites and ticks. Arachnids are primarily terrestrial forms, but a few are secondarily adapted to aquatic environment. Majority of arachnids are carnivorous. Arachnids can survive without feedings for long periods of time. The class is further sub—divided into 10 orders. Of these the four orders relevant to the present compilation are Scorpionidea, which includes scorpions; Araneida, which includes the spiders; Chelonethi, which includes false scorpions or pseudoscorpions and Acarina which includes ticks and mites.

Order: Scorpionidea:

Scorpions are the oldest known terrestrial arthropods. These are largely restricted to the tropical and sub—tropical regions. Scorpions are generally nocturnal, hiding by day under wood, stones, crevices etc. Scorpions have stinging apparatus attached to the posterior end of postabdomen (tail). Venom is produced by a pair of oval glands situated within thestingingapparatus. Venom of Indian scorpions is not toxic enough to kill human beings, but certain African and Mexican species have very highly toxic venom that can be fatal to human beings. Before mating scorpions carry on an extensive courtship after which the male is stung to death by his consort. Scorpions are viviparous—give birth to young ones. Development of eggs takes place within the ovarian tubules of the mother. After the young ones are born they crawl upon the mother's back where they remain till the 1st moult after which they leave the mother and become independent. Reports show that members belonging to 5 families are represented in Kerala. ***Pychas tricarinatus***; ***Chiromacheates fergusoni***; ***Palamnaeus scaber***; ***P. oatesii***; ***Thelyphonus sepiaris indicus***; ***T.S. muricola*** and ***Phrynichus phipsoni***.

Order: ***Araneida:***

This order includes spiders and is one of the largest orders of arachnids. Unlike the scorpions, spiders have the poison apparatus located in the chelicera—an appendage at the anterior end of the body. Except in the case of a few species, venom of spiders is not toxic enough to kill human beings, but causes allergic manifestations. The abdomen of spiders bears a group of modified appendages known as spinnerets or the spinning organs. The silk glands associated with these lie in the abdomen. Silk of the spider is a scleroprotein which is secreted by the glands as a fluid. Hardening of the silk results not from exposure to air but from the actual drawing out process itself. A single thread is composed of several fibres. Silk plays an important role in the life of spiders and it is put into a variety of use, such as building of web to catch prey, using it as a casing for eggs, as a drag—line etc. Web building by spiders is a remarkable feat and considerable knowledge regarding this has been provided by Pharmacologists who have found the alteration in a spider web—building behaviour as an excellent means of differentiating drug effects. Spiders like most arachnids are carnivorous and feed mostly on insects. Complex pre—copulatory behaviour—counting—is exhibited by spiders. Members belonging to 13 families have been reported from Kerala.

Araneus dehaanii; Argiope aemula; A. pulchella; Cyrtophora moluccensis; Gasteracantha geminata; G. hasseltii; Herennia ornatissima; Leucauge tessellata; L. ventralis; Nephila maculata; N. malabarensis; Orsinome marmorea. Annandaliella travancorica;

Order: ***Chelonethi:***

This order includes what is popularly known as pseudoscorpions. These are tiny arachnids living in leaf mold, soil, beneath barks and stones etc. These superficially resemble scorpions. These feed on small arthropods. Members belonging

to 5 families are reported from Kerala. These have been collected from either under decaying leaves or bank. *Tyrannochthonius chelatus; Euryolpium (E). aureum; Apocheiridium indicum; Paratemnus ceylonicus* and *Indochernes beieri.*

Order: *Acarina:*

This order includes ticks and mites which are of great economic importance. Ticks are blood—sucking external parasites of vertebrates. Many species of mites have adapted to parasitic existence. They parasitise both vertebrates and invertebrates and even plants. Some mites have become internal parasites. Scabies in human beings and mange in several animals are produced by mites. Some are free—living and certain others are destructive to food and other products. Ticks transmit several diseases, especially viral, to human beings and domestic animals. A typical example of a tick—transmitted disease in India is Kysanur Forest Disease which occur in certain forest areas of Karnataka State. Both Argasid (soft bodied) and Ixodid (hard—bodied) ticks are present in Kerala. A familiar example of hard—bodied tick is the dog tick—*Rhipicephalus* sp. Knowledge of prevalence, distribution and ecological relationships acarines especially ticks is very pooor and an extensive survey of these would be very fruitful. The following is an account of plant parasitic and free—living mites reported from Kerala. Plant parasitic mites: *Euseius bambusae*—host unknown; *E. cocosocius*—host unknown;

E. ovalis from paddy plant. *Amblyseius channabasavanni* from chrysanthemum; *A. largoensis* from coconut and rose; *Typhlodromalus kalimpongensis, Typhlodromips tetranychivorus*—host unknown; Neoseiulus suknaensis from rose plant. The Pink or Orange Mite *Acaphylla theae* causes damage to the leaves of tea plant. The Purple Mite *Calacarus carinatus* attacks leaves of tea plants. *Aceria jasmini* is a pest of jasmine. *Hemitarsonemus latus* infests leaves of pulses. *Raoiella indica* is a pest of coconut and areca palm. The Scarlet Mite *Brevipalpus phoenicis* infests tea, coffee and rose plants. *B. obovatus* is a

pest of coffee. *Tetranychus hindustanicus* infests leaves of coconut palm; *T. fijiensisa* is a pest of coconut and areca palms. *T. urticae* attacks brinjal, tapioca and Lady's Finger. *Oligonychus coffeae* attack tea coffee plants. *O. indicus* is a pest of areca palm. *Eutetranychus orientalis* and *Oligonychus biharensis* are pests of tapioca. Soil inhabiting mites: *Cryptacarus polysetosus; Lepidacarus ornatissimus; Annectacarus tivandricus; Haplacarus foliatus; Javacarus indicus; Malacoangelia remigera; Eremulus wallworki; Eremobelba nagaroorica; Basilobelba retiarius; Multioppia indica; Stachyoppia indica; Suctobelbila approximata; Suctobelba semiplumosa; Otocepheus trivandricus; Fissicepheus aokii; Microzetes auxiliaris; Galumna flabellifera; Galumnella angustifrons; Hoplophorella scapellata.*

(X) PHYLUM. MOLLUSCA:

This phylum includes the familiar forms like snails, oysters, squids, clams, mussels etc. These are generally soft—bodied animals, the body usually protected by calcareous shell. Molluscs are the most numerous group of animals after insects. These are adapted to all possible habitats—marine, fresh—water, terrestrial. Some are parasitic. This phylum is divided into 6 Classes. Those relevant to the present context are the Class Gastropods, scaphopoda and Cephalopoda.

Class: *Gastropoda*:

This class includes snails typically provided with spirally coiled shell (often wanting). Typical examples are the Apple Snail—*Pila*; the Limpet—*Patella*; the Sea Hare—*Aplysia* etc. The shell has salts of calcium especially calcium carbonate; salts of aluminium; mangenesium, iron, copper etc. Several freshwater and marine forms belonging to about 18 families coming under 6 orders have been recorded from Kerala:

The Limpet *Cellana radiata* is a marine from inhabiting intertidal zone adhering to rocks. The Sacred Chank (Sanghu) *Xancus pyrum* inhabits fine or soft sandy areas. *Nerita albicilla* is abundant during March—May and would be found attached

to submerged structure. *Littorina undulata* is abundant during March—July are found attached to submerged structures. *Cerithrium terssa; Cerithidea fluviatilis; Melania tuberculata* (a fresh—water form); *M. scabra; M. lineata; M. pyramis; Calyptrae (Crucibulum) extinctorum; Natica marochiensis; N. tigrina; Thiara riquetti; Nassa ceylonica; Conus punctatus; Lymnaea luteola; L. accuminata; Indoplanorbis exustus.* It is important to note that *Melania tuberculata; Lymnaea luteola; L. accuminata* and Indoplanorbis were reported to be found naturally infected with cercaria (immature stage of flukes). These are fresh—water forms. The other gastropods reported are: *Streptaxis peroteti; S. watsoni; S. beddomi; Ennea turricula; Ariophanta cysis; A. thyreus; A. belanger; A. basilessa; A. beddomii; A. gassii; Indrella ampulla; Euplecta pulchella; E. semidecussata; E. subcastor; E. travancorica; E. indica; E. albizonata; E. acuducta; E. mucronifera; E. apicata; E. orbiates; Macrochlamys woodiana; M. prava; M. vilipensa; M. peringundensis; Mariaella beddomei; Pseudaustenia atra; Satiella dekhanensis; S. levidensis; S. pertenuis; Sitala palmaria; S. injussa; Asteronotus caespitosus; Phyllidia (Phyllidia) varicosa* and *P. (P) zelanica.*

Class : Scaphopoda :

These are burrowing marine molluscs that are popularly known as tusk or tooth shells. The shells are elongated cylindrical tube usually shaped like a trumpet or elephant's tusk and are open at both the ends. These forms are adapted to burrowing habits. These have no eyes, tentacles or gills. The reports from Kerala are mainly based on the shells collected and not on live specimens. *Dentalium octangulatum; D. aparinum; D. elpis* and *D. esper* are the reports from Kerala coast.

Class : Bivalvia : (Pelicipoda) (Lamellibranchia)

This class includes common forms as clams, oysters and mussels. These are laterally compressed and poses a shell with two valves hinged dorsally. Reports show that bivalves belonging to 5 orders have been reported from Kerala. Of these *Nuculana mauritiana* appears to be the only report from the order Nuculacea. Those belonging to families Mytilidae, Ostreidae etc. are of great commercial importance.

Arca inaequivalvis inhabits silty region and found during February—April. *A. indica* is a rare species. Reports on *A. laterilis* and *A. tortuosa* are based on the empty shells collected. Kallumalkai[Kadukka *Mytilus viridis (Perna viridis—?)* is found attached to submerged structures. abundant during January—April. *M. edulis* inhabits rocky shores. *Modiolus undulatus* is found attached to submerged structures. *M. striatulus* is abundant during December—April. Reports on *M. tulipa* are based on empty shells. *Pecten tranquebaricus* is a marine species. The window—pane oyster *Placenta placenta* inhabits muddy bottom of bays and creeks which are more or less land locked. Muringa Muru *Crassostria madrasensis* is abundantly seen in backwaters and esturies. Spawning period is during November—December. *C. cucullata* found in the inter—tidal zone of the rocky coast. *C. discoidea* found in littoral zone. *Ostrea forskalii* found in large clusters on submerged structures. They attain maximum size during December—April crassostria and ostria are of commercial importance. *Lucina ovum*. Two major species of Villorita are represented along Kerala coast. These are of commercial importance. *Villorita cyprinoides* is a brackishwater species and cannot withstand salinity variations. *V.c.* var. *cochinensis*. Though a brackishwater species it can withstand salinity variations. These are seen in large numbers throughout the year. but large specimens are seen mostly during December—April. *V. cornucopia* is another brackishwater species. The Bay Clams *Meretrix meretrix* spawns during March—June and is of commercial importance. *M. casta* and *M. ovum* are of economic importance and are found in all backwaters of Kerala.*Dosinia cretacea* appears to be the only species of Dosinia reported based on collection of live specimen. The other species of *Dosinia; D. modesta; D. trigona* and *D. histrio* were recorded based on the collection of empty shells. Live specimens of *Paphia marmorata* were collected during December—May. The other two venerids whose report is based on live specimens are: *Catelysia opima* and *Chione tiara*. Venerupis macrophylla; Venus imbricata; Paphia malabarica and Circe scripta were reported only from empty shells. Standella pellucida occurs in fairly good numbers during dry seasons and are found in silty areas.*Donax scrotum and D. cuneatus* are widely distributed the latter being more abundant

than the former. The report on *D. spiculum* a marine species, is based on empty shells. Report on *Theora opalina*, a marine species, is based on the empty shells obtained. Report on of *Tellina rhodon* and *T. pinguis* are based on collection of live specimens. *Solen aquae—dulcioris*. Live specimens of this species were collected during dry months. Two species of Martesia recorded are: *Martesia striata* and *M. (Martesia) fragilis*. These are wood boring molluss and found in large numbers in submerged timber structures. Reports on the occurrence of *Pholas (Monothyra) orientalis* is based on empty shells collected while dredging. *Dicyathifer manni* (=Teredo *manni); Lyrodus pedicellatus (=Teredo malaccana; T. madrasensis); Teredo clappi (=Teredo renschi);* T. *furcifera (=*T. *furcilatus); (=B. edmondsoni; B. (Bankiella) consularis); B. campanellata (=Liliobankia) campanellata)* and *Nausitora hedleyi (=Nausitora) gabrieli)* are all wood boring molluses.

Class : Cephalopoda :

This class includes cuttlefish, squids, octopus etc. Except a few like ocipus, all the others are actively swimming forms. Cephalopods are all marine. *Spirula spirula* inhabits depths of 200—1500 m. and are widely distributed *Sepia aculeata* breeds during February-April and July-August. *S. arabica; S. dliptia* and *S. pharaonics* are the other three species of Sepi a recorded. *Sepiella inermis; Inioteuthis maculosa; Loligo duvauceli (indica); Sepioteuthis lessoniana, Loliolus investigatoris; Abralia andamanica; Abraliopsis gilchristi* and *Thelidioteuthis allessandrinii. Symplectoteuthis qualaniensis; Chiroteuthis (Chirothauma) imperator; Megalocranchia abyssicola; Liocranchia* sp: *Japatella diaphana; Grimpoteuthis grimaldi; octopus (octopus) rugosus; O(O). tonganus; Cistopus indicus.*

Phylum : Echinodermata

These are radially symmetrical free living or sedentary marine organisms with non-segments body and without a demarkated head region. In free-living forms movement is effected by tube feet. Familiar examples of this phylum are starfishes and sea urchins. The Phylum is divided into five

Classes : Crinoidea (Sea lily); Asteroidea (starfish); ophiuroidea (Brittle star); Echinoidea (Sea urchin) and Holothuroidea (Sea cucumber). Of these Classes, reports (James, 1970 and Personal communication) show that ophiuroidea, Echinoidea and Holo-thuroidea have representatives in Kerala. Kerala is poor in echinoderms due to the absence of coral reefs.

Class : Ophiuroidea

Amphioplus (Lymnella) depressus and *Macrophiothrix aspiodota*

Class : Echinoidea

Phyllacanthus imperialis; Stomopneustes variolaris and *Clypeaster humilis.*

Class : Holothuroidea

Leptopentacta javanicus; Holothuria (Selenkothuria) moebii; and *H. (Semperothuria) cineracens.*

Division B. : Phylum : Chordata

This phylum is distinguished by the presence of a dorsal skeletal rod called the notochord either in the early stages of development or throughout life; presence of pharyngial clefts used for respiration (in higher vertebrates these are embryonic and non-functional); presence of tabular nerve cord (unlike the solid and ventrally placed nerve cord of invertebrates) placed dorsally. This phylum is divided into 4 sub-phyla; Hemichordata; Cephalochordata; Urochordata and Vertebrata. In sub-phylum Vertebrata, the notochord is replaced either wholly or partly by a cartilaginous or bony segmented vertebral column.

Sub Phylum Cephalochordata

These are marine organisms small in size and fish-like in appearance but without paired fins, jaws, or vertebrate but with persistant notochord. A dorsal tubular nerve cord is present, but it is not differentiated into brain. Skull, limbs, scales. These remain buried in the sand at the sea bottom occasionally coming up to the surface of water. These are filter-feeders (feed by sweeping a current of water into the mouth by means of cilia and filtering the microscopic organisms present in the current) and their food consists of microscopic

organisms. The Cephalochordata has a single family the Branchiostomatidae. The one representative of this family reported from Kerala waters is *Branchiostoma lanceolatum* (earlier known as *Amphioxus lanceoolatum*).

Sub-phylum Urochordata (Tunicata)

These are marine animals enclosed in a nest of tunic. These may be fixed or free-living and swimming. Notochord is found in the adults of free-living forms but not in the sedentary ones. In the latter notochord is found only in the Larval stages. This sub-phylum is divided into three Classes : Larvacea; Thallacea and Ascidiacea. *Pyrosoma sedentarium* (Class Thallacea); *Herdmania ennurensis* and *Didemnum psamathodes*, both belonging to Class Ascidiacea, are reported from Kerala Waters.

Class : Elasmobranchii

Order : *Lamniformes* The Cat Banded Shark *Chiloscyllium griseum* (Korangan sravu). The Ridge-back Cat Shark *C. indicum* (Etti.) The Whale Shark *Rhinodon typus* (Thimingala sravu Pulli udumbu). The Zebra Shark *Stegostoma varius* (Zebra sravu). The Dog Fish *(Atelomycterus marmoratum* (Udumpan Sravu). The Whitecheeked Shark *Carcharshinus dussumieri* (Karimthala sravu). The Gangetic Shark Ground Shark of the rivers Long-- tailed Shark *C. gangeticus* (Valiya sravu). The Grey Shark *C. limbatus* (Pettiyan sravu). The Blackfinned Shark Black Shark *C. melanopterus* (Mookan sravu Raman sravu). The Grey Shark

C. menisorrah (Mandi sravu). The longsnout Shark *C. temminckki* (Thekkan sravu Pulliyan sravu). The Tiger Shark *Galeocerdo articus* (Kalla sravu Pulliyan sravu). The Grey Dog Shark *Scoliodon palsorrah* (Palsravu). The Yellow Dog Shark *S. Sorrakowah* (Pooyi sravu Aulpidiyan). The Sharpnosed Shark *S. walbeehmi* (Kayaruketty sravu Perum sravu). The Light-tip Shark *Triaendodon obesus* (Chora sravu). The Arrowheaded Hammerhead Shark *Sphyrna blochii* (Kannankodi Chetta sravu). The Squat-headed Hammerhead Shark *S. zygaena* (Chattithalayan sravu).

Important shark fishery of west coast constitute Scoliodon Carcharinus, Galeocerdo and Sphyrna. Sharks are available

throughout the year but the peak season is from July to March. Sharks are caught from coastal waters ranging in depth from 35 to 30 fathoms.

Order : Rajiformes

The Granulated Shovelnose Ray *Rhinobatos granulatus* (Kalpoonthi). The whitespotted Shovelnose Ray *Rhynchobatus djiddensis* (Varithala). The Pointed Saw Fish *Pristis cuspidatus* (Makara sravu). The Smalltoothed Saw Fish. *P. microdon* (Kompan sravu). The Scaly Sting Ray *Dasyatis imbricata* (Mookan thirandi). The Pale-edged Sting Ray. *D. Zugei* (Karum thirandi). The Banded Whiptail Sting Ray *D. uarank* (Manal thirandi Pulliyan thirandi) The Cowtail Ray *D. sephen* (Adavalan thirandi Kodivalan thirandi). The Longtailed Butterfly Ray *Gymnura poecilura* (Perum thirandi). The Spotted Eagle Ray *Aeobatus flagellum* (Pullikakka thirandi). The Nieuhofs Eagle Ray *Aetomylus nichofii* (Kaniyan thirandi). The Javanese Cow Ray *Rhinoptera javanica* (nel thirandi). The Lesser Devil Ray *Mobula diabolus* (Koman thirandi Koorman thirandi Melthirandi)

Rays are caught from coast shallow waters at a depth of 10 to 15 fathoms.

Class : Teleostomi

Order : Clupeiformes

The Giant Horring *Elops saurus* (Valli poomeen). The Tarpon *Megalops cyprinoides* (Valathan Kanni Nachil). This is a fast growing marine carnivore but is known to enter estuaries. The Long Ray Bony Bream *Nematalosa nasus* (Kozhi meen). The Shortedged Gizzard Shad *Anodontostoma chacunda* (Kuntadi mathi). The White Sardine *Kowala coval* (Veloori Chooda). Fishing season for this fish along the west coast is from September to November. The Longfinned Herring/Razor Edge *Opisthopterus tardoore* (Ambatta). The Indian Herring *Pellona ditchela* (Kannan mathi). The Smoothback Herring Raconda ruselliana (Thada). The Shortbodied Sardine *Sardinella albella* (Parappan Chala/Vatti chala). The spwning season of this fish is from February to July. The Fringescale Sardine *S. fibriata* (Chala mathi/Kari chala). The Fishing season of

this sardine is from May to January. The Indián Sprat *S. gibbosa* (Kathi chala). The Oil Sardine *S. longiceps (*Mathi Nala mathi). Spawning season of this sardine extends from August to September and fishing season begins immediately after the southwest monsoon and lasts from August to March with a peak season from September to December. The Blacktipped Sardine *S. melanura* obtained mainly from Kerala; *S. sindensis* is occasionally caught from the southern part of the Kerala coast; *S. sirm* occurs along both the coasts of South India. The White Bait *Solephorus malabaricus* (Kozhua). The Common Sprat *Dussumieria acuta* (Kolakoyan Kolachi). The Van Hasselt's Sprat *D. hasselti*. The fishing season of this sprat is from November to March. The Commerson's Anchovy *Anchoviella commersonii* (Nethal Netholi). The Indian Anchovy *A. heterolobus*(Kari nethal). This species spawns throughout the year. The Indian Anchovy *A. indica* (Nethal). The 'Indian Anchovy *A. tri* (Vella nethal). The Golden Anchovy *Coillia dussumnieri* (Kathi managu Valan manangu). The Sussumier's Anchovy *Thrissocles dussumieri* (Cheru managu). Fishing season of this anchovy is mainly from June to September. The Malabar Anchovy *T. malabaricus* (Kavu manangu). The mustached Anchovy *T. mystax* (Nedumanangu). Spawning season of this anchovy is from September to May and the maximum catch is during October- December. The Anchovy *T. purava* (Kavu challa). This anchovy breed inestuaries and tidal reaches of rivers, juvenile stages ascend streams. The Longjaw Anchovy *T. setirostris* (Mullan managu). The Dorab Wolf Herring *Chirocentrus dorab* (Mulla vala). The Milk Fish *Chanos chanos* (Poomeen). The Featherback *Notopterus notopterus* (Ambattan vala).

The clupeoid fishes as a group are commercially important marine fishes. Along the west coast large shoals of oil sardine occur and the zone of maximum abundance being the Malabar region. Oil sardine fishery starts immediately after the commencement of the south-west monsoon and lasts from August to March. Shoals first appear in the Calicut region and spreads towards the north. On Kerala coast the chief fishing centres for anchovies are in the Malabar area (Kozhikode, Quilandy, Parappanangadi etc.).

Order : Scopeliformes

The Bombay Duck *Harpodon neherus* (Bombalaya/Bummili) marine form breeding throughout the year with a peak season from November to March. It migrates offshore for breeding. The Greater Lizard Fish *Saurida tumbil* (Arana meen/Veempili).

Order : Cypriniformes

This order is a vast one of fishes inhabiting chiefly freshwater. Only catfishes belonging to the families Plotosidae and Tachysuridae are adapted to life in the sea. Those marked with a (+) sign are commercially important fishes. The Chocolate Mahasheer *Acrossocheilus hexagonolepis* (Karampi). The Attentive Carplet *Amplypharyngodon melettinus* (Vayampu/Thuppal kothi). The Mola *A. mola* (Oolari). The Indian Trout *Barilius gatensis* (Venta kurichi). The Golden Carp *Carassius carassium* (Swarna meen). The Catle *Catla catla* (Kara katla/Kenta)+. The Winged Rasbora *Chela laubuca* (Mathi paral)+. The White Carp *Cirrihinus cirrhosa* (Venkata)+. The Marigal *C. mrigal* (Mrigalalm). The Reba *C. reba* (Reba)+. The Common Carp *Cyprinus carpio* (Carp)+. The Giant Danio *Danio aequipinnatus* (Malabar danio). The Flying Barb *Esomus danrica* (Meesa parava)+. The Stone Carp *Garra mullya* (Kamau/Kallu nakki). The Calbasu *Labeo calbasu* (Karutha meen/Kakka meen). The Common Labeo *L. dussumieri* Thooli rohu). The Fringelipped Carp *L. fimbriatus* (Piri chundan/Chenchundan)+. The Pigmouth Carp *L. kontius* (Pannivayan)+. The Rohu *L. rohita* Rohitham). The Scarletbanded Barb *Puntius ambhibia* (Oolee paral/Urulan paral)+. The Carnatic Carp *P. carnaticus* (Kavery kenta). The Green Barb *P. chola* (Poovan)+. The Buchanan's Carp *P. curmuca* (Kaadi meen)+. The Filsmented Barb *P. filamentosus* (Kachi paral)+. The Jerdon's Carp *P. jerdoni* (Tameen)+. The Blackbanded Barb *P. melanmphyx* (Kylie). The Olive Carp *P. sarana* (Kuruka paral/Kuruva). The Stigma Barb *P. sophore* (Undakannl)+. The Firefin Barb *P. ticto* (Kadum kali). The Striped Barb *L. vittatus* (Cheli kunthi). The Common Rasbora (*Rasbora daniconius* Thuppal kudiyan)+. The Rohtee *Rohtee bakeri* (Mullan paral). The Kudree Mahseer *Tor khudree* (Attu kenda). The Mussullah Mahseer *T. mussullah* (Paral).

The Tor Mahaseer *T. tor* (Meruval/Kooral). (Family. Colbitidae). The Striped Loach *Noemacheilus botia* (Attumeen/Kalkanni)+. The Butterfly Catfish *Ompok bimaculatus* (Manjavala/Valappottu). The Freshwater Shark *Wallago attu* (Attu vala)+. (Familu. Claridae). The Freshwater Catfish *Clarius batrachus* (Muzhi/ Musi)+. The Stinging Catfish *Heteropneustes fossillis* (Kari/ Kaduku meen)+. The Striped Catfish Eel *Plotosus anguillaris* (Moorghee)+. The Canine Catfish Eel *P. canius* Puzha mushi)+. The Stone Loach *Travancoria jonesi* (Attunta). The Soldier Catfish *Osteogeniosus militaris* (Venkidi etta)+. The Marine Catfish *Tachysurus dussumieri* (Valiya etta)+. The White Catfish *T. jella* (Vella etta). The Spotted Catfish T.*maculatus* (Thedu). The Dusky Catfish *T. sona* (Koman etta)+. The Shortnosed Catfish T. *subrostratus* (Chundan etta). The Giant Catfish T. *thalassinus* (Navetta)+. The Longwhiskered Catfish *Mystus aor* and *M. gilio* (Manjal etta and Vella Koori respectively)+. The Giant River Catfish *M. seenghale* (Karadu)+. The Striped Dwarf Catfish *M. vittatus* (Etta chulli/Chillan/ Kallan koori)+.

Oreder : Anguilliformes:

The Freshwater Eel *Anguilla bangalensis (Aarel*[(Aarel/Mananjil/Vilangu). This is commonly found in the coastal and offshore waters. Anguilla sp. is a catadromous fish which descends into the sea for breeding. The elevers ascend the freshwater from sea and grow to maturity in the riverine environment. This fish is one of commercial importance. The Black Eel *Muraena pseudothyrsoidea* (Kari aarel). The Common Eel *Muraenesox talabon talabon* (Aarel). Samuel states that The Silver Conger Eel *M. cinereus* is recorded from all along the coasts of India. These fishes frequent coastal and offshore waters. The Oriental Worm Eel *Lamnostoma orientalis* (Kadal vilangu). *Order: Beloniformes:*

These are predominantly marine fishes, but some are freshwater. The Fullbeaked Garfish *Strongylurua strongylura* (Kola). A commercially important fish seen in small shoals. Enters estuaries for spawning during the months of September— December. The Freshwater Garfish *Xenentodon*

cancila. The Longbilled Halfbeak *Hemirhamphus georgii*. Samuel's list show record of the following species of helfbeaks from Kerala waters. *H. xantho-pterus; H. unifasciatus* and *H. richardi*. Half—beaks are commercially important fishes. The Two Winged Flying Fish *Exocoetus volitans* (Parava kola). ·The breeding season of this fish extends from May to July.

Order: *Cyprinidontiformes*:

The Striped Top Minnow *Aplocheilus lineatum* (Varayan Poonjan). The Lesser Top Minnow *A. panchax* (Poonjan). The estuarine Top Minnow *Oryzias melasti-gmus* (Poochutti/Manathukanni).

Order: *Beryciformes*:

These are marine fishes of coral reefs, some are deep—water species. The Red Soldier Fish *Holocentrus rubra* (Katantha mulli) The Black—tipped Soldier Fish *Myripristis murdjan*. (Unda kanni).

Order: *Mugiliformes*:

The Giant Sea Pike *Sphyraena jello* (Thinda/ Cheelavoo), a marine form. The Mullet *Liza corsula* (Kanampu). The Grey Mullet *Mugil cephalus* (Thirutha). This is a coastal species entering esturies, lagoon and backwaters. It spawns only once a year and the fishing season is from January to June. Reports show that ths species thrives well in brackishwater farms in Kerala (Narakkal, Ayiramthengu and Mali-ppuram) and constitutes abut 75% of the catch. The Mullet M. parsia (Malan/Kanampu) is anestuarinespecies The Hardy Head *Allenetta forskali* (Thalayil kallan).

Order : *Polynemiformes*:

Polynemids are found along the east and west coasts of India, both in the inshore and the offshore fishing grounds. The Indian Salmon *Eleutheronema tetradactylus* (Bahmeed/Thamuthi). The adults are known to ascend the rivers during winter season. These are caught in the west coast during September to November. The Giant Threadfin *Polydactylus indicus* (Nurakudiyan). The Threadfine *Polynemus sextarius* (Cheeral). The Common Tassel Fish *P. plebeius* (Poothaladi).

Order : *Ophiocephaliformes* :

The Brown Snakehead *Channa gachua* (Vatton/Manathu

kannan). The Giant Snakehead *C. marulius* (Vaha Varal). The Snakehed *C. micropelitis* (Cheru meen). The Green Snakehead *C. punctatus* (Pulli varal). The Striped Snakehead *C. striatus* (Varal). Fishes belonging to this Order inhabit freshwater.

Order : *Perciformes* :

The Giant Perch *Lates calcarifer* (Nari meen/Kodum thala). The Waigeu Sea Perch *Pasmoperca waigensis* (Chen kanni). The Glassy Perchlet *Ambassis dayi* (Nanthan/Mullan chooda). The Nakedhead Glassy Perchlet *A. gymnocephalus* (Nanthan). The Indian Glass Fish *A. thomassi* (Mullan chery). These are small shoaling fishes. The Yellow Rock Cod *Epinephelus flavocaerules* (Manja kalava/Manja karoop). The Banded Rock. Cod *E. lanceolatus* (Varayan Kalava/ Varayan karoop). The Spotted Rock Cod E. *maculatus* (Kalava/Karoop). The Red Rock Cod *E. sonnerati* (Chem kalava). The Speckled Rock Cod *E. tauvina* (Panni kalava). The Bared Reef Cod *E. diacanthus*. *E. bawnack*. The Crescent Perch *Therapon jarbua* (Keeri/Varayan Keeri). The Squeaking Perch *T. puta* (Pulli keeri/Savam kothi). These fishes are known to enter estuaries. The Sand Whiting *Sillago sihama* (Nongal/Poozhan/ Pooyan/Kathiran) a marine form. The Threadfinned Trevally *Alectis ciliaris* (Tongal para). The Indian Threadfin Trevally *A. indicus* (Para). The Kuweh *Atropus atropus* (Kannipara). The Blacktailed Trevally Carnax carangus (Karivalan para). The spawning season of this fish is from August to September and peak season to catch is from August to November. The Yellowfin Trevally *C. ignobillis* (Manjavalan Para). The Brownbacked Trevally *C. praeustus* (Kana para/Oolim para). The Sixbanded Trevally *C. sexfasciatus* (Varayan para). The Malabar Trevally *Citula malabaricus* (=Carans carangoides) (Kooli para. The oblong Trevally *C. oblongus* (thol) para). The Russel's Scad *Decapterus russelli* (vatta para). The breeding season of this fish is from November to February. The Horse Mackerel *Megalaspis cordyla* (Para/Kana meen). The spawning season of this fish is from November to December. The Leather Jacket *Scomberoides lysan* (Palameen). The Deep Queen

Fish *S. tala* (Palameen). The Goggler *Selar crumenophthalmus* (Champan). This is the most important Horse mackerel of the west coast. The Scad *S. djedaba* (Ovu para). The Golden Scad *S. kalla* (Kandam para/Kall para). The Slender Scaled Scad *Selaroides leptolepis* (Rama para). The Bailon's Dart *Trachinotus bailloni* (Thali para/Vella adavu). The Bigjawed Jumper *Lactarius lactarius* (Parava/Adavu/ Adu). Fishing season of this fish is from May to September. A marine form. The Butter Fish *Ranchy-centron canadus* (Neimeen/Mezhu meen). The Moon Fish *Mene maculatus* (Ambattan para). The Dolphin Fish *Coryphaena hippurus* (Dolphin meen). Marine inhabitant. The Snappers are predaceous marine fishes of the rocky coasts and coral reefs. Peak fishing season is during the months of June July. The Family is represented by the Red Snapper *Lutianus argenti-maculata*; The Black—spotted Snapper *L. johnii*; the Rosy Snapper *L. lutjanus* and the Malabar Snapper *L. malabaricus* (All the four species of Snappers are called Chemballi in Malayalam). The Threadfin Breams contribute to the littoral and reef fisheries of South India. This Family is represented by the Japanese Threadfin Bream *Nemipterus japonicus* (Kilimeen). This is common in trawl catches of Kerala coast. The Brown Triple Tail *Labotes surinamensis* (Parandi/Aeri). The Silver Bellies or Pony Fishes are coastal fishes usually seen in large shoals and are found all along the coasts of India and constitute a good proportion of the fish landings from Kerala. Fishing season lasts from July to November. This family is represented by the Toothed Pony Fish *Gazza minutus* (Mòdam mullan/ Karal). The Orangefinned Pony Fish *Leiognathus bindus* (Nalla mullan). The Silverbelly *L. blochii* (Thuppakki mullan). The Slenderbarred Pony Fish *L. insidiator* (Chakkara mullan/Paal kurichi). The Deepbodied Pony Fish *L. ruconius* (Thakara mullan). The Splendid Pony Fish *L. splendens* (Thali mullan). The Longrayed Silver Perch *Gerres filamentosus* (Prachil/Pranjil). The Lined Silver Grunter *Pomadasys hasta* (Karukaruppan). A marine fish the spawning of which is after the south west monsoon. The Spotted Grunter *Pomadasys hasta* (Karukaruppan). A marine fish the spawning of which is after the southwest monsoon. The Spotted Grunter *P. maculatus* (Eruttum kora). *Plectorhynchus niger*. Marine fishes represented by the Silver Jew Fish *Johnius dussumieri*

(Cheru kora). The Silver-banded Jew Fish *Otolithes argenteus* (Palli kora). The Rosy Jaw Fish *O. ruber* (Thol kora). The Twospined Jaw Fish *Pseudosciaena diacanthus* (Kora). Peak catch of this fish occurs during April-June. The Drab Jew Fish *P. sina* (Mutti kora).Coastal fishes represented by the Silverspotted Sea Bream *Lethrinus cinereus* (Pulli vala meen/Kadu). The banded Sea Bream *L. nebulosus* (Kadu vala meen). The Red Mullet *Upeneus vittatus*.(Keeri meen/Puthiyapila kora). The Yellow Goat Fish *U. sulphureus*. Both these species of mullets are common in the west coast. The Banded Bat Fish *Monodactylus argenteus* (Vaval meen/Varayan meen). The Silver Bat Fish *M. falciformis* (Paranthee). The Black Bream *Sparus berda* (Aree). The Spade Fish *Ephippus orbis* (Thavanakary). The Long-finned Bat Fish *Platax pinnatus* (Kannadi para). The Spotted Bat Fish *Drepane punctata* (Painthi). The Ringed Angel Fish *Pomacanthodes annularis* (Tharathi). The Vagabond Coral Fish *Chaetodon vagabandus* (Manjakkalli meen). The Spotted Etroplus *Etroplus maculatus* (Pallathi). The Banded Etroplus *E. suratensis* (Kari meen/Eru meen). Thr Tilapia *Tilapia mossambica* (Tilapia). The Whitespotted Spinespot *Siganus oramin* (Karadumeen). The Barred Surgeon Fish *Acanthrus triostegus* (Vari para). A marine fish. The Largeheaded Ribbon Fish *Trichirus haumela* (Kasi thalayan). Large shoals of these ribbon fishes enter the inshore waters during August-October. It spawns only once a year during June and the fishing season is from June to October. The Smallheaded Ribbon Fish *T. salva* (Velli thalayan). The peak season of this fish along the Kerala coast is from May to September. The Indian Mackerel *Rastrelliger kanagurta* (Ayala) a pelagic shoaling species.

The fishing season in Kerala is between August to February and spawning is from June to September. The Short Corseletted Frigate Mackerel *Auxis thazard* (Elichoora). The Long Corseletted Frigate Mackerel *A. thynnoides* (Elichoora). The Mackerel Tuna *Euthynnus alletteratus affinis* (Urulan choora/ Kana meen/Mas meen). The Dog Tooth Tuna *gymnosarda unicoloe* (Choora). The Stripped Tuna *Katsuwonus pelamis* (Choora/Sooda). The Northern Bluefin Tuns *Kishinoella tonggol* (Kethal). The Yellow Tuna *Neothunnus macropterus* (Manja choora/). The Big-eyed Tuna *Prathunnus onesus* (Vattakannan

choora). The Oriental Bonito *Sarda orientalis* (Choora). Fishing season of this fish is from June to September. The Seer fishes *Scomberomorius commersoni* and *S. guttatus* (Ayakora/Varimeen). Fishing season of seer fishes starts immediately after the close of the south-west and north-east monsoons. March toOctober and Novemberto February are the months when they are obtained. Spawning season is from May to July with a peak period in July. Both the fishes are marine.' The Broadbill Sword Fish *Xiphias gladius* (Vall meen). This species usually occurs beyond the limit of the continental shelf. The Indian Sail Fish *Histiophorus gladius* (Ola meen/Mayil meen). The Black and the Stripped *Marlins Makaira indica* and *m. mitsukurii* (marlin). The Shortnosed Sword Fish *Tetrapturus brevirostris* (val meen). These are economically important pelagic food fishes occuring in small shola. The Grey/Silver Pomfret *Pampus argenteus* (Velutha avòli). The Chinese Pomfret *P. chinensis* (Mantha avoli/Machan). The Black Pomfret *Parastròmateus niger* (Karutha avoli). Pomfrets are highly prized marine fishes. Fishing season is mainly during June-September. The major fishing centres in Kerala are Badagara, Puthiakadappuram and Paravanna. The Climbing Perch *Anabas testudineus* (Antikalli/Karippidi/Kallada mutti). The Gourami *Osphronemus goramy* (Gourami). These fishes are found in stagnant or slow flowing waters with sumerged vegetation. The Indian Humhead *kurtus indicus* (Thala muzhayan). Marine. The Bar-eyed Geby *Glossogobius giuris* (Paichi/Vayapottan/Poonthy). The Malabar Goby *Stenogobius malabaricus* (Kurudan meen). The Burrowing Goby Tripauchen vagina (Chettuaarel). The Rough Flathead *Platycephalus indicus* (orathal). The Indian Flathead *Thysanophrys indicus* (Eriyan).

Under Order Perciformes the perches, ribbonfishes, horse-mackerels, queen fish, dolphin fish, king fish, silver bellies, white fish, pomfrets, seer fish and tunnies constitute important marine fish landings from Kerala coasts.

ORDER: *PLEURONECTIFORMES:* The Toothed Flatfish *Psettodes erumei* (Àirampal manthal/Ayirampalli). Marine.

The Largetoothed Flounder *Pseudorhombus arsius* (Nalla Manthal). The Three Spot Flounder *P. triocellatus* (Oulli manthal). Both these fishes are marine. The Sole *Brachirus albomaculata* (Kallu manthal). The Commerson's Sole *B. commersoniani* (Ola manthal). The Oriental Sole *Solea elongata* (Nanku manthal). The Brown-tongue Sole *Cynoglosus areal*; The Fourlined-tongue Sole *C. bilineatus*; The Shoulderspot-tongue Sole *C. lida*; The Largescaled-tongue Sole *C. macrolepidotus* (all these species of soles are called Manthal in Malayalam). The Long-tongue Sole *C. lingua* (Valan manthal). The Spotted-tongue Sole *C. puncticeps* (Vella manthal). The Fivelined-tongue Sole *C. quinquelineatus* (Vari manthal). The Malabar Sole *C. semifasciatus* (vala manthal). This fish constitutes an important sole fishery northwards from Quilon along the Kerala coast. Sole fishery in general starts towards the end of south-west monsoon and continues till November.

ORDER: MASTACEMBELIFORMES:

The Lesser Spiny Eel *Macrognathus aculeatus* (Aarel). The Spiny Eel *Mastacembelus armatus* (Mookkan arakan). Fresh water fishes.

ORDER: ECHENEIFORMES:

The Starry File Fish *Balistes stellatus* (Moori). The Slender Sucker Fish *Echeneis naucrates* (Pattu meen/Ekki). The Common Sucker Fish *Remora remora* (Pattu meen).

ORDER: TETRODONTIFORMES:

The Starry File Fish *Balistes stellatus* (Moori). The shortnosed Tripod Fish *Triacanthus brevirostris* (Klathi). The Spotted Borcupine Fish *Diodon hystrix* (Pulli petha). The

Reticulated Blow Fish *Arthron reticularis* (Petha).

Attempts have been made to introduce Brown trout in Kerala eversince 1909 but with little success. However, attempts to introduce the Rainbow Trout *(Salmo gairdneri gairdneri:* Family Salmonidae. Order Clupeiformes) have met with success and according a report this trout appeared to be well established by 1941—42 and now they occur in certain streams (Nullatani, Kadalaar etc.) lakes (Devikulam, Erairkulam etc.) and reservoirs (Kundaly, Madupatty).

CLASS: AMPHIBIA:

Frogs and Toads are familiar examples of this class. Evolved from Fishes, the amphibians invaded the terrestrial environment. Yet these cannot be said to have a total terrestrial existence. In most cases part of their life cycle is still spent in water. The tadpole (immature stage of frogs and toads)is aquatic and looks more like a fish. Frogs and toads feed on worms and insects. Toads are endowed with skin glands secreting poison. Order Apoda are worm-like in appearance and are limbless. Generally there is no aquatic larval stage. Order Anura includes frogs and toads Typically the larvae of these are aquatic and resemble fishes. These pass through metamorphosis to become adults.

ORDER: APODA:

Gegeneophis carnosus: Uraeotyphlus narayani; U. menoni; U. oxyurus' U. malabaricus; Ichthyophis subterrestris; I. beddomii; I. peninsularis; I. tricolor and *I. malabaricus* are the species of caecilians recorded from Kerala. The main breeding period of I. malabaricus is during March-September.

ORDER: ANURA:

Rana hexadactyla; R. ctanophlyctis; R. tigrina; R. gracilis; R. verrucosa; R. rufescens; R. breviceps; R. beddomii; R. semipalmata R. leptodactyla; R. diplosticta; R. malabarica; R. curtipes and *R. temporalis*. *Rhacophorus pleurostictus; R. maculatus; R. malabaricus* and *R. lateralis*. *Ixalus opisthorhodus; I. fuscus; I. Silvaticus; I. saxicola; I. leucorhinus; I. beddomii; I. pulcher; I. variabilis; I. glandulosus; I. chalazodes; I. flaviventris* and *I. signatus, Micrixalus nudis, Nyctibatrachus pygameus; N. major; Nannobatrachus beddomii*. Six species belonging to the genus Bufo and one belonging to the genus Nectophryne have been reported from Kerala. The Common Indian Toad *Bufo melanostictus*; The Ferguson's Toad *B. fergusonii*; The Beddom's Toad *B. beddomii*; The Southern Hills Toad *B. microtympanum; B. hololius; B. parietalis. Nectophryne tuberculosa*. (Family. Microhylidae) (=Engystomatidae). The Black Microhylid *Melanobatrachus indicus* is a rare species collected only from the Anamalais and other hill ranges in Kerala. These inhabit the moist evergreen forest at 1219 m. elevations. The Ornate *Microhyla ornate* is one of the smallest Indian amphibian adapted to live in different biotopes. These are found in the plains and upto 1524 m. in the hills. The Red Microhylid *M. rubra* frequents low country areas and is not recorded north of Malabar in the Western India. The Marbled Balloon Frog *Uperodon systoma* burrows in loose soil. Breeding season is during June—July. The Triangle-spotted Ramanella *Ramanella triangularis* frequents forest areas. Jerdon's Ramnella *R. montana*. *Breeding coincides* with monsoon and these probably aestivate after the rains. The two other species reported are *Callula obscura* and *C. triangularis*.

CLASS: REPTILIA:

This class includes the lizards, snakes, turtles, tortoises etc. These are cold blooded vertebrates. Skin is dry and covered with horny scales and mostly devoid of skin glands. These are adapted secondarily invaded aquatic habitats. These have no skin or gill breathing. Air breathing is done by lungs. Eggs are laid on land and are protected by a porous shell through which gas eaxchange can take place. A membrane

bag called amnion encloses the embryo and contain a fluid called amniotic fluid. This helps to prevent desiccation of the developing embryo. Reptiles along with birds and mammals fall under the group Amniota because of the presence of amnion, in contrast to fishes and amphibia which are Anamniota and which lays eggs in water. Lizards come under the order Squamata, snakes come under the order Ophidia, crocodiles come under the order Crocodilia and turtles and tortoises come under the order Chelonia.

ORDER: SQUAMATA:

Cnemaspis indica (Gonatodis indicus); C. ornata (G.ornatus); C. beddomei (G. Marmoratus). All the three are small sized lizards occurring in hilly regions of the State. *Hemidactylus triedrus* (palli) is commonly seen on trees in low country and hills upto 1300m. The House Gecko *H. brooki* and *H. frenatus.* The Flying Lizard/Flying Dragon_*Draco dussumieri (*Para onthu) inhabit low country and coconut and aracanut plantations. *Sitana pondiceriana,* inhabit open country. *Salea anamallayana* inhabits hills upto 2300 m. *Octocryptis beddomii; [calotes grandisquamis* and *C. nemoricola* are confined to the hills. *C. ophiomachus* and *C. rouxi* are found in the hills and the low country. *C. versicolor* (Onthu/OnanU one of the commonest lizards. *Psammophilus blandfordanus* ——*Charasia blandfordanus)* inhabits hilly areas and probably low country also. *Chamaelion zeylanicus (C. calcaratus)* inhabits forest regions. The Common Skink *Mabuya carinata* (Aranai) occurs all over the country.*M. bibroni, Dasia subcaerulea (Lygosoma sucaerulea). Lygosoma dussumieri* is the commonest skink of the low country. *L. dawsoni* is a rare skink recorded from the High Ranges. *Leiolopisma travancoricum (Lygosoma travancoricum)* and *L. beddomei (Lygosoma beddomei)* are forms inhabiting hills. *Riopa albopunctata (Lygosoma albopunctatum)* and *R. guentheri (L. guentheri)* were recorded from south Kerala. Other forms inhabiting the hills of Kerala are: *Ristella rurki; R. travancorica; R. guentheri* and beddomi occur in the hills. *Cabarita leschenaulti* inhabits low country hills. *Varanus monitor (v. bengalensis) (Udumpu[Neduvali).*

Order : Ophidia :

Typhlops porrectus (Kurutippampu[Kurutanpampu[Kolippampu). The Common Blind Snake *T. braminus* (Brahminikkurutippampu/ Kolippampu/kuruttanppampu). Mostly lives underground or in decaying vegetation.*T. thurstoni (Amminjikutiyanpampu). T. tindalli* (Thindalkkurutippampu). *T. beddomei* (Vellamookkan Kurutippampu) frequents hilly areas 600 to 1000 m. *T. acutus* (Kokkurutippampu). *Melanophidium punctatum* (Melivalan pampu) *M. wynaudense* (Kadan melivalan pampu). *Platypluctrus trilineatus* (Varayan melivalan pampu) inhabits hilly areas. *P. madurensis* (Thavittu melivalan pampu) frequents hilly areas from 1300 m. to 2000 m. *Teretrus sanguineus* (Chemmelivalan pampu), inhabits hills 1000 to 21000 m. *Plectrurus perroteti* (Mulluvalan pampu) frequents hilly areas. *P. guentheri* (Panadan mulla valan pampu). *P. aveeus* (Chambrakkunnan pampu). *Uropeltis ellioti* (Chemvalayan pampu) frequents hilly tracts. *U. nitidus* (Kariruthalayan pampu) frequents hills 1300 to 1500 m. *U. ocellatus* (Iruthalakkannan pampu). Viviparous snake inhabiting hills. *U. beddomei* (Manjeruthalayan pampu). *U. macrorhynchus* (Oriruthalayan pampu) found buried in loose earth in forest areas. It is a viviparous snake. *U. woodmasoni* (Karatiyiruthalayan pampu). *U. ceylanicus* (Lankiruthalayan pampu) inhabits hilly areas. *Branchyophidium rhodogaster* found in loose sandy soil. *U. articeps* (Kunniruthalyan pampu). *U. rubromaculatus* (Kumkumappottan pampu). *U. rubrolineatus* (Kumkumavarayan pampu) frequents hilly areas. *U. phipsoni* (Manjakkuriyan pampu). U. myhendrae (Manjavalayan pampu) frequents hilly areas. *U. maculatus* (Chorakkuttan pampu), inhabits hills upto 2000 m. *U. pulneyensis* (Pazhanippampu) hills upto 1500 to 2500 m. *U. grandis* (Manjakkarithalayan pampu) frequents hills upto 1300 to 1500 m. *Rhinophis sanguineus* (Adichoppan Munpampu). *R. fergusonianus* (Munpampu) frequents hilly areas. *R. travancoricus* (Thekkan mun pampu). *Python molurus* (Perum pampu/Malampampu). It is common in hilly areas. It is oviparous and eggs are laid after winter season. *Eryx conicus* (Mannuli pampu/Mannuni pampu/Mannutheenippampu/Mandalippampu/Payyanippampu). Very common snake which is oviparous and lays eggs during summer months.*E. johni* (Erattathalayan pampu/

Mandalippampu) *Acrochordus granulatus* (Kayal pampu) inhabits sea shore and lakes. Viviparous. The Trinket Snake *Elaphae helena* (Kattu pampu) found in and around fairly thin jungle. Oviparous. Dhaman/Rat Snake *Ptyas (Zamenis) mucosus* (Chaera/Karavala/Kattuvala). Common and essentially a snake of the plains but not uncommon in the hills. Oviparous. *Coluber fasciolatus* (Valayan cheera). Not very common. *Liopeltis calamaria* (Chennivarayan pampu). Oviparous. The Wolf Snake *Oligodon vensutus* (Orachurutta). Oviparous. *O. travancoricus* (Thekkanchurutta). The Banded Kukri Snake *O. arnensis* (Muvarayan churutta). Essentially a snake of the plains but also found in hills at elevations upto 2000 m. Non-poisonous oviparous snake. *O. affinis* (Malanchurutta). *O. brevicauda* (Kuttivalan churutta) inhabits hilly areas. *Ahaetulla ahaetulla* (Dendrophis pictus) (Komberippampu/Villoonni/Billoonni). The Bronze-back Snake *A. grandoculis* (Malankomberippampu). Oviparous. *A. bifrenalis* (Kattukomberippampu). *A. caudolineolata* (Nalvarayankomperippampu) inhabits hilly areas. *A. tristis* (dendrelaphis tristis) (Villoonni) oviparous. *Lycodon travancoricus* (Chaeralav). Nocturnal, commonly found in hilly areas but frequents plains also. The Common Wolf Snake *L. aulicus* (Vellivarayan pampu/Churutta/Shankhuvariyan/Chuvarppampu). it is a house dweller frequently found in unused boxes, almirahs etc. Oviparous. The Bridal Snake *Drycalamus nympha* (vellithalayan pampu/Churutta/Shamkhuviriyan). nocturnal frequenting both plains and elevated areas.

Oviparous. *D. gracilis* (Venkottazhakan pampu). *Sibynophis subpunctatus* (Ezhuthanichurutta). The Checkered Keel-back Snake *Natrix piscator* (Neerkkoli/Thannippampu/Thenneerppampu/Neerppampu/Kulamandali). Oviparous form which lays its eggs during March-April. *N. stolata* (Theyyan pampu/Theyyam pampu/Tharliyan pampu/Daivathankutti Padakooti). Oviparous form. Eggs are laid during April-May. *N. beddomei* (Kattuneerkkoli). found at elevations of 1000—2300 m. *N. monticola* (Malaneerkkoli). *Macropisthodon plumicolor* (pachchanagam). oviparous. *Atretium schistosum* (Pachchaneermandali). *Rhabdops olivaceus* (Monthayunthi ppampu) *Xylophis perroteti* (Parottippampu) *X. stenorhynchus* (Orakkullanpampu). The snakes listed so far are all non-pois-

onous. Snakes with slight poison: The Golden Tree Snake *Chrysopelea ornata* (Nagathan pampu). Essentially an arboreal snake, oviparous. hardly secretes any poison but strikes viciously. The Cat Snake *Biogatrigonata* (Poochakkannan pampu). Oviparous. *B. ceylonensis* (Kattuvalayan pampu). *B. forsteni* (Karikkuriyan pampu). *B. dightoni* (Peeramedan pampu). *Dryophis dispar* (Malambacholappampu). The Common Green Whip Snake *D. nasutus* (Pacholappampu/Pachappampu/Pachilappampu/Kankothippampu). Lives chiefly on bushes and shrubs. Semi-poisonous and bites freely. *D. pulverulentus* (Thavittolappampu). *Enhydris dussimieri* (Thatichippottan pampu). *E. sieboldi* (Venthatichippottan pampu). The Dog-faced Water Snake *Cerberus rhynchops* (Aattuvayppampu). Oviparous. Frequents coastal areas. *Gerardia pervostiana* (Pacha atuvay pampu).

Poisonous Snakes : *Bungarus caeruleus* (vellikkettan/Valavazhappan/Kattuviriyan) Commonly found in the plains and hills upto 1220 m. Nocturnal. Egg laying during April-May. The Slender Coral Snake *Calliophis melanurus trimaculatus* (Ezhuthanimoorkhan). Found both in the plains and hills at low altitudes. Oviparous. *C. (Hemibungarus) nigrescens* (Ettatimoorkhan). frequents elevated places between 914 and 2133 m. Young ones are seen during June. July and August. *C. bibroni* (Ezhuthanivalayan). Cobra *Naja naja* (Moorkhan pampu/Nallapamu/Nagam/Nallanagam/Sarpam/Vembala/Pullani/Pullanji). frequents both hilly areas and thickly populated plains. Mating season is between January and March and eggs are laid during April-May. The King Cobra *Naja hannah* (Karinatan pampu/Karinjathi/Karunagam/ Malanagam/ Krishna sarpam/Ettativeeran). frequents forest areas. Mating season is between March and May. Oviparous. (Family Hydrophidae) *Kerilia jerdoni* (Kerilippampu). Littering during June-July. *Praescutata viperina* (Katal mandeli). *Enhydrina schistosa* (Valakatiyan pampu/Thunippampu). Littering during February-May. *Hydrophis spiralis* (Valayankotali). Littering during February-August. *H. cyanocinctus* (Karalorakkotali). Frequents coastal areas. *H. ornatus* (Chittulippampu). Littering during June-August. *Lapemis curtus* (Arabippampu). Littering during May-July. *Astrotia stokesi* (Katalthadiyan pampu). Littering during August-September. *Microcephalophis gracilis* (Cheru-

thalayan katalpampu/Kotali/Mulakukotian). Littering during July-August. *M. cantoris* (Cannoorkatal pampu). *Pelamis platurus* (manakkaryan katalppampu). Mating during October-December and littering during March-May. (Family. Viperidae). The Russell's Viper *Vipera ruselli* (Chenathandan/Mandali/Payyanimandali/Raktamandali/Rudhiramandali/ Pullan/Anali/Raktaanali/Kannativiriyan), frequents plains and hilly places. Nocturnal. Mating during December-May. Viviparous. Littering during June-July. The Sidewinder/Saw-scaled Viper *Echis carinatus* (Churuttamanadali) frequents dry sandy and rocky areas, rarely in elevations above 914 m. Mating season during November-March. Viviparous littering during June-July. *Agkistrodon hypnale* (Marayanali) frequents hilly terrain and found only above 914 m. *Trimeresurus (Lachesis) macrolepis* (Chattithalayan pampu) Common in tea estates. Littering season during September-November. T. **malabaricus** (Kattumandali), freqüents hilly terrain at elevations about 610—2133 m. Littering during February-August. T. **stringatus** (Latamandali) found at elevations about 914-1825 m. *T. gramineus* (Mulamandali). Mating usually during winter months and littering during April-July.

ORDER: CROCODILIA. The Estuarine Crocodile/Salt Water Crocodile **Crocodilus porosus**, (Muthalai) inhabits rivers and backwters, occassionally swimming to sea. The Marsh Crocodile/Mugger C. *palustris* (Cheenkanni). It is a freshwater crocodile occurring in most of the rivers.

ORDER CHELONIA :Green Turtle, Edible Turtle *Chelonia mydas*. The most common marine turtile. The Hawksbill Turtle/Tortoiseshell/Turtile/Caret) **Eretmochelys imbricata**, is a marine form and an occasional visitor to Kerala coast. The Logger-head Turtle *Caretta caretta gigas*. Marine and fairly common (as per Travancore State Manual) on Kerala coast. The Leatherback Turtle/Leathery Turtle/The Luth/Trunk Turtle *Dermochelys coriacea*, a marine form and a rather rare visitor to Kerala coast. *Geoemyda trijuga*, frequents ponds and pools. The Indian Flashell Turtle *Lissemys punctata* (Pal amai). The River Turtle *Pelochelys bibroni* (P. cantorii). commonly found in rivers. The Indian Star Tortoise *Testudo elegans*, is a land tortoise. T. **travancorica** frequents hills upto 1000 m.

CLASS: AVES (BIRDS)

Birds have evolved from reptiles and are warm-blooded animals. Body is clothed by feathers. Scales are present only on legs. In most cases the fore-limbs are elaborated into wings for flight. Their whole organisation (both external and internal) is modified for their aerial habit. But some of them are secondarily adapted to aquatic habitats. Eggs are laid on land and the embryo is protected by shell and amniotic fluid. Eggs are provided with large quantity of yolk. Adults show parental care in incubating the eggs and bringing up the young ones.

The exhaustive account of birds of Kerala by Salim Ali shows that a little over 300 species of birds distributed to 14 Orders have been recorded from Kerala. These include both resident and winter migratory birds.

ORDER: PODICIPEDIFORMES: The Indian Little Grebe/Dabchick ***Podiceps ruficolis capensis*** (Kulapatta/Moongankozhi). Resident inhabiting low country ponds and lakes. Nesting during August.

ORDER: PELECANIFORMES: The Little Cormorant ***Phalacrocorax niger*** (Kakkattaravu). Resident inhabiting neighbourhood of tanks and rivers. The Indian Darter, Snake Bird ***Anhinga rufa melanogaster*** (Cherakozhi). Resident inhabiting tanks, dammed reservoirs etc. Nesting during September.

ORDER: CICONIIFORMES: The Eastern Grey Heron ***Ardea cinerea rectirostris*** (Charamunti). Status and breeding of this bird need confirmation. Frequents backwaters and sea coasts. The Eastern Purple Heron. ***A. purpurea manilensis*** (Chayamunti). Resident frequenting tanks and coastal backwaters. Nesting during JulySeptember. The Indian Little Green Brittern ***Butorides striatus chloriceps*** (Chinna kokku). Resident frequenting banks of rocky streams of low country and upto 600 m. Nesting during May-June. The Indian Pond Heron/Paddy Bird ***Ardeola grayii grayii*** (Kumamunti/Kulakokku). Resident inhabiting paddy fields, tanks etc., of low country and upto 900m. Nesting during May-August. The Cattle Egret ***Bubulcus***

ibis coromandus (Kalimunti). Resident inhabiting low country paddy fields. Nesting during May-June. The Eastern Large Egret *Egretta alba modesta* (Perumunti). Resident inhabiting coastal backwaters, paddyfields etc. The Indian Smaller Egret *E. intermedia intermedia* (Cherumundi). Resident frequenting tanks, paddyfields, coastal backwaters etc. Nesting not recorded from Kerala. The Little Egret *E. garzetta garzetta* (Chinnamunti). Resident frequenting tanks, streams, paddy fields etc. Nesting not recorded from Kerala. The Indian Reef Heron *E. gularis schistacea* (Thiramunti). Resident frequenting coastal backwaters. Nesting not recorded from Kerala. The Night Heron *Nycticorax nycticorax nycticorax* (Thoppi Kokku/Pathira-kokku). Resident frequenting tanks, coastal backwaters etc., Nesting not recorded from Kerala. The Malay Bittern *Gorsachius melanolophus melanolophus* (Thavittukokku). Resident inhabiting foothills and upto 750 m. in the hills near streams and marshy patches. Nesting during May-July. The Chestnut Bittern *Ixobrychus cinnamomeus* (Sandhyakokku/Mazhakocha). Resident frequenting paddy fields. Nesting during May-June. The Yellow Bittern *I. sinensis sinensis*.(Manjakokku). Resident inhabiting low country and upto 900 m. Nesting not recorded from Kerala. The Black Bittern *Dupetor flavicollis flavicollis* (Karingkocha/Kaitakokku). Resident frequenting dense vegetation on the banks of canals and tanks. Nesting during May-June; The Openbill Stork *Anastomus oscitanus* (Cherakokkan). Resident inhabiting neighbourhood of water bodies. Nesting not recorded from Kerala. The Whitenecked Stork *Ciconis episcopus episcopus* (Karimkokku/Karavarakuru). Resident frequenting river banks, paddy fields etc. Nesting not recorded from Kerala. The Smaller Adjutant Stork *Leptoptilos Javanicus* (Vayalnaicken). Status and nesting need confirmation. Frequents low country and hills upto 600 m.

ORDER: ANSERIFORMES: The Lesser/Common Whistling Teal *Dendrocygnajavanica* (Yeranda). Presumably a resident frequenting weed covered tanks. Nesting not recorded from Kerala. The Common Teal *Anascrecca crecca* (Yeranda). Winter visitor frequenting neighbourhood of water bodies. The Garganey/Bluewinged Teal *A. querquedula* (Vari yeranda). Winter visitor frequenting water bodies. The White-eyed

Pochard *Aythya nyroca (Yeranda)*. Winter visitor frequenting open back-waters. The Cotton Teal *Nettapus coromandelianus coromandelianus* (Yeranda). Winter visitor frequenting irrigation and village tanks.

ORDER: FALCONIFORMES: (Family. Accipitridae) The Black-winged Kite *Elanus caeruleus vociferus* (Velli-eriyan). Winter visitor frequenting open grass jungle in foot-hills and upto about 1050 m. The Indian Blackcrested Baza *Aviceda leuphotes leuphotes*. (Prapparundu). A resident bird of the evergreen biotope. Nesting February and April. The Crested Honey Buzzard *Pernis ptilorphynchus ruficollis* (Ten kotichi). Frequents deciduous and semi-evergreen forest. The Common Pariah Kite *Milvus migrans govinda* (Chakkiparundu). Resident, low country Nesting November to February. The Brahminy Kite *Haliastur indus indus* (Garudan/Krishnaparundu). Resident, low country. Nesting between February and March. The Shikra *Accipiter badius* (Prappidian/Shikra) Resident, low country. Nesting between January and April. The Crested Goshawk, Asiatic Sparrow Hawk and the Besra Sparrow Hawk are called by the Malayalam name Prapidiyan. The Crested Goshawk *(A. trivirgatus Peninsulae)* Prappidian and the Besra Sparrow Hawk (*A. virgatus besra)* are resident birds frequenting heavy forests and nesting during March-May. The Asiatic Sparrow Hawk *(A. nisus nisosimilis)* Prappidian is a winter visitor. The Japanese Desert Buzzard *Buteo buteo burmanicus* (Parundu) is a winter visitor. The White-eyed Buzzard Eagle *Butastur teesa* (Parundu). Very rare bird, inhabiting dry scrub low country. The Ceylon Feather-toed/Legge's Hawk Eagle *Spizaetus nipalensis kelaarti* (Parundu). Resident, inhabiting hilly areas. Nesting during December to March. The Indian Crested Hawk Eagle *S. cirrhatus cirrhatus* (Kinnariparundu). Resident, low country, nesting during January to March. The Booted Hawk Eagle *Hieraaetus pennatus* (Parundu). Occasional winter visitor.

The Rufousbellied Hawk Eagle *Lophotriorchis kienerii* (Eriyan). Resident recorded from the hilly areas, nesting during November to March. The Black Eagle *Ictinaetus malayensis perniger* (Karimparundu). Resident frequenting hilly areas. Nesting during November to March. The White-bellied Sea Eagle *Haliaeetus leucogaster*. (Parundu). Resident frequenting sea coast. Nesting between October and January. The Grey-headed

Fishing Eagle *Icthyophaga ichthyaetus* (Vala parundu). Resident Nesting during November to March. The Black/King Vulture *Torgos calvus* (Kazhukan/Kathilakaran). Low country as well as hills. Nesting between December and April. The Longbilled Vulture *Gyps indicus indicus* (Kazhukan). Low country and hills. Whitebacked/Bengal Vulture *G. bengalensis* (Kazhukan/ Chuti kazhukan). Resident, low country. Nesting between November and March. The Smaller White Scavenger Vulture *Neophron percnopterus ginginianus* (Totti kazhukan). Resident frequenting low country in the neighbourhood of towns and villages. Nesting between February and April. The Pale Harrier *Circus macrourus* (Medutappi). Winter visitor. The Montagu's Harrier *C. pygargus* (Madutappi) winter visitor. The Pied Harrier *C. melanoleucos* (Medutappi). Winter visitor. The Marsh Harrier *C. aeruginosus aeruginosus* (Karitappi). Winter visitor. The Short-toed Eagle *Circaetus gallicus gallicus* (Parundu). Resident, low country and hills. The Crested Serpent Eagle *Spilornis cheela melanotis* (Chuttipparundu). Resident, low country and hills. Nesting between December and March. The Osprey/Fish Hawk *Pandion haliaetus haliaetus* (Talipparundu). Winter visitor. The Eastern Peregrine Falcon *Falco peregrinus japonensis* (Kayal pullu). Winter visitor frequenting coastal bckwaters and freshwater tanks. The Shahin Falcon *F.P peregrinator* (Karimpullu). Frequents hilly regions. Indian Hobby *F. severus rufipedoides* (Chempullu). Winter visitor, frequenting open wooded country. The Redheaded Merlin *F. chicquera chicquera*. Frequents open deciduous country. The European Kestrel *F. tinnunculus tinnunculus* (Cherupullu). Winter visitor frequenting low country and hills. The Indian Kestrel *F.T. objurgatus*. Resident frequenting open cultivated or scrub country.

ORDER: GALLIFORMES:

The Southern Grey Partridge *Francolinus Pondicerianus pondicerianus* (Kozhi kata). Resident, frequenting open scrub country and cultivation. The Black—breasted/Rain Quail *Coturnix coromandelica* (Kata). Frequents grass. The Blue-breasted Quail *C. chinensis chinensis* (Kata) Resident frequenting grassland. The Jungle Bush Quail *Perdicula asiatica* (Varikada Para varikada). Resident frequenting dry scrub country. Nesting during December to March. The Painted Bush Quail

P. erythrorhyncna erythrorhyncha (Menkata). Resident frequenting evergreen and moist deciduous biotope. Hills above about 750 m. Nesting season is distributed throughout the year. The Travancore Red Spurfowl *Galloperdix spadicea stewarti* (Mullan kozhi). Resident found in forest areas—deciduous and semi—evergreen biotope. Foothills and upto at least about 1050 m. Nesting during January—April and September—October. The Grey Junglefowl *Gallus sonneratii* (Kattukozhi) Resident frequenting evergreen and moist deciduous biotope in foothill and upto about 1350 m. Nesting during February—July. The Common Peafowl *Pavo cristatus* (Mayil). Resident but rare. Salim Ali (1969) suggests the need for protection of this bird from human predators

ORDER:GRUIFORMES:

The Yellow—legged/Indian Button Quail *Turnix tanki tanki* (Kada). Resident but rare frequenting grassland in low country and hills upto 1200 m. Nesting in January. The Common Bustard Quail *T. suscitator taigoor* (Kata). Resident but rare inhabiting low country and hills upto about 900 m. Resident but rare inhabiting low country and hills upto about 900 m. The Whitebreasted Waterhen *Amaurornis pheoenicurus phoenicurus* (Kulakozhi). Resident frequenting banks of ponds in low country and upto 900 m. They are also found near inundated paddy fields. Nesting during April—October. The Ruddy Crake *A. fuscus zeylonicus* (Chenkozhi). Resident but less common inhabiting low country and upto about 900 m. Nesting during June—September. The Purple Coot/Gallinule *Porphyrio porphyrio poliocephalus* (Neela kozhi). Resident, common frequenting inundated paddy fields in low country. Nesting July—August.

ORDER: CHARADRIIFORMES:

The Bronzwinged Jacana *Metopidius indicus* (Eerkili kala, Thamara kozhi) Resident inhabiting tanks in low country. Nesting June to September. The Pheasant—tailed Jacana *Hydrophasianus chirurgus* (Thamarakozhi/Valan Thamarakozhi). Resident inhabiting low country tanks. (Family Haematopodidae) The Oystercatcher/Sea pie *Haematopus ostralegus* (Kakka patta) is a winter visitor. (Family. Charadiriidae). The Redwattled Lapwing *Vanellus indicus indicus* (Chankanni). Resident inhabiting low country tanks and such other water bodies.

Nesting during March to August. The Yellow—wattled Lapwing *V. malabaricus* (Manjakanni). Resident frequenting dry open land in low country. Nesting during March to August. The Eastern Golden Plover *Pluvialis dominica fulva* (Manal kozhi): The Large Sand Plover *Charadrius leschenaultii leschenaultii* (Manal kozhi); The Little Ring Plover *C. dubius curonicus* (Motira kozhi); The Kentish Plover *C. alexandrinus alexandrinus* (Manal kozhi) and the Pamirs Lesser Sand Plover *C. mongolus atrifrons* (Manal kozhi) are all winter visitors. The Whimbrel *Numenius phaeopus phaeopus* (Tetti—kokku); The Curlew *N. arquata* (Vaalkokku); The Redshank *Tringa totanus eurhinus* (Chorakkali); The Marsh Sandpiper *T. stagnatilis* Chatuppan); The Greenshank *T. nebularia* (Pachakkali): The Green Sandpiper *T. ochropus* (Kata—kokku/Karimben kadakokku): The Wood/Spotted Sandpiper *T. glareola* (Kata—kokku): The Common Sandpiper *T. hypoleucos* (Neerkata): The Turnstone *Arenaria interpres interpres* (Tirakkata); The Wood Snipe *Capella nemoricola* (Chuntankata): The Pintail Snipe *C. stenura* (Chuntankata): The Common/Fantail Snipe *C. gallinago gallinago* (Chuntankata); The Jack Snipe *C. minima* (Chuntankata); The Woodcock *Scolopax rusticola* (Prakata): The Little Stint *Calidris minutus* (Kuruvikokku); The Curlew—stint/Pigmy Sandpiper *C. testaceus* (Katalkata) and The Broadbilled Sandpiper *Limicola falcinellus* (Katalkata) are all winter visitors. The Painted Snipe *Rostratula benghalensis benghalensis* (Kalikata). Resident inhabiting reedy marshes and paddy fields in low country. Nesting during December to February. (Family, Burhinidae). The Indian Stone Curlew/Goggle-eyed Plover *Burhinus oedicnemus indicus* (Vayalkannan). Resident inhabiting dry low country. The Indian Courser *Cursorius coromandelicus* (Veli-alappan). Resident inhabiting open low country. Nesting during May to July. The Small Indian pratincole Swallow-plover *Glareola lactea* (Kuruvi-kozhi). The status of this bird needs confirmation. Ferguson recorded it from Velayani near Alwaye. Gulls and Terns are represented by The Great Black-headed Gull *Larus ichthyyaetus* (Katalpatta): The Brownheaded Gull *L. brunnicephalus* (Katalpatta/Thavituthalayan katalkakka); The Blackheaded/LaughingGull *L ridibundus* (Katalpatta) The Indian Whiskered Tern *Chlidonias hybrida indica* (Katalkakka); The Gullbilled Tern *Gelochelidon nilotica nilotica* (Katalkakka); The

Caspin Tern *Hydroprogne caspia caspia* (Katalkakka); The Common Tern *Sterna hirundo* (Katalkakka); The Ternlet *S. albifrons* (Katalkakka);. The Large Crested Sea Tern *S. bergii velox* (Katalkakka) and The Indian Lesser Crested Sea Tern *S. bengalensis bengalensis* (Katalkakka) are all winter visitors to Kerala.

Order : *Columbiformes* : The status, habitat and nesting of the Common Sandgrouse *Pterocles exustus erlangeri* needs confirmation. This bird is reported to have been collected from low country areas in Travancore. The Southern Green Pigeon *Treron phoenicoptera chlorigaster* (Choola/Pacha pravu). Resident inhabiting deciduous and semi-evergreen low country and hills upto about 900 m. Nesting during January to May. The Greyfronted Green Piegon T. *pompadora affinis* (Charraviriyan). Resident inhabiting wooded low country, foothill and upto 1200 m. Nesting during December to March. The Orangebreasted Green Piegon T. *bicincta bicincta* (Manjaviriyan). Resident inhabiting low country forest. Nesting presumably during January to March. The Ceylon Green Imperial Piegon *Ducula aenea busilla* (Meni pravu) Resident low country and foothills. Nesting during February to June. The Jerdon's Imperial Piegon *D. badia cuprea* (Manti pravu/Pokanna). Resident inhabiting heavily forested foothills, wooded ravines and sholas upto 1500 m. Nesting during January to May. The Indian Blue Rock Pigeon *Columba livia intermedia* (Kutta pravu/Ambala pravu). Resident inhabiting low country. Nesting probably throughout the year. The Nilgiri wood Pigeon *C. elphinstonii* (Marapravu). Resident inhabiting evergreen biotope of foothhills and upto the highest shlas. Nesting during April to June. The Indian Spotted Dove *Streptopelia chinensis suratensis* (Chakkara kutta pravu, Aripravu). Resident inhabiting low country and upto about 1050 m. Nesting throughout the year. The Indian Little Brown Dove S. *seenegalensis cambayensis* (Aripravu). Resident inhabiting dry open low scrub jungle. The Indian Emerald Dove *Chalcophaps indica salimalii* (Omanapravu) Resident inhabiting low country, foothills and upto 1350 m. Nesting during April to May and November to December.

Order : Psittaciformes : The Roseringed Parakeet *Psittacula krameri manillensis* (Tatha/Motirattatta). Resident inhabiting low country. Nesting during December to April. The Western Blossomheaded Parakeet *P. cyanocephala cyanocephala*

(Poontatta). Resident inhabiting low country and hills upto 1050 m. Nesting during February to April. The Blue-winged Parakeet *P. columboides* (Nilattatta). Resident inhabiting hills from 450 m. and 1050 m. Nesting during January to March. The Malabar Lorikeet *Loriculus vernalis rubropygialis* (Tattachinnan) Resident inhabiting low country, foothills and upto 1200 m. Nesting during January to March.

Order : *Cuculiformes* : The Redwinged Crested Cuckoo *Clamator coromandus* is probably a winter visitor. The Pied Crested Cuckoo *C. jacobinus jacobinus* (Erattattalachi kuyil). Resident inhabiting deciduous low country. Nesting during April-May. The Common Hawk-cuckoo/Brainfever Bird **Cuculus varius varius** (Shikra kuyil). Resident inhabiting low country and foothills. Nesting during March-April. The Indian Cuckoo *C. micropterus micropterus* (Chakkakkuppundo kuyil). The status of this bird needs confirmation. It is silent during off-season but very vocal during breeding season which extends from March to June. It is an arboreal bird. Though specimens of the Cuckoo *C. canorus* (Kuyil) and Baybanded Cuckoo *Cacomantis sonneratii sonneratti* (Chenkuyil) have been collected from Kerala, their status and breeding need to be confirmed. Similarly the status, breeding etc., of the Indian Plaintive Cuckoo *C. merulinus passerinus* (Cherukuyil) and theIndianDrongo-cuckoo*Surniculus lugubris dicruroides* (Kakkathampurattikuyil) need confirmation. The Indian Koel *Eudynamys scolopacea scolopacea* (Kuyil/Pullikuyil/Kakkakuyil/Nattukuyil). Resident inhabiting low country and upto 300 m. Nesting during January-May. The Small Green billed Malkoha *Rhopodytes viridirostris* (Pachachundan). Resident inhabiting foothills. Nesting chiefly between March and May. The Southern Sirkeer Cuckoo *Taccocua leschenaultii leschenaultii* (Kalli kuyil). Resident inhabiting low country and upto 900 m. Nesting chiefly during March-May. The Southern Crow-pheasant/Coucal *Centropus sinensis parroti* (Uppan/Chembothe). Resident inhabiting low country, foothills and upto 1500 m. Nesting chiefly during November-May. The Lesser Coucal/Crow-pheasant *Centropus toulou bengalensis* (Vari uppan). Resident inhabiting foothills and upto at least 900 m. Nesting probably between August and September.

Order : Strigiformes : The Barn Owl Tyto alba stertens (Velli

moonga). Resident inhabiting low country near human habitation. Nocturnal. Nesting practically throughout the year but chiefly during December-January. The Grass Owl *T. capensis longimembris*. Reported as a rare resident bird. Nesting probably during November-December. The Collared Scops Owl *Otus bakkamoena bakkamoena* (Nattu). Resident inhabiting low country and foothills. Nesting during January-February. The Indian Great Horned Owl *Bubo bubo bengalensis* (Kompan moonga). Resident inhabiting open country with ravines and boulders. Nesting not recorded from Kerala. The Forest Eagle Owl *B. nipalensis nipalensis* (Kattu moonga). Resident inhabiting low country and hills upto 1500 m. Nesting during December-January. The Brown Fish Owl *B. zeylonensis leschenault* (Ooman/Meenuman). Resident inhabiting low country and forest in the neighbour hood of tanks and streams. Nesting not recorded from Kerala. Nocturnal. The Malabar Jungle Owlet *Glaucidium radiatum malabaricum* (Chemban nattu). Resident inhabiting low country and foothills. Nesting during March-May. Active during day and night. The South Indian Hawk-owl *Ninox scutulata hirsuta* (Pullunattu). Resident inhabiting low country and hills upto 900 m. Nesting during January-May. Active during day time. The Southern Spotted Owlet *Athena brama brama* (Kampi-peechan/Pullinattu/Kampilleechan). Resident inhabiting low country and upto about 450 m. Nesting during March-April. Nocturnal. The Mottled Wood Owl *Strix ocellata ocellata* (Kollikkuravan/Kalankozhi). Resident inhabiting low country and frequenting neighbourhood of human habitation. The Shorteared Owl *Asio flammeus flammeus* (Poocha moonga) is a winter visitor.

Order : Caprimulgiformes : The Ceylon Frogmouth *Batrachostomus moniliger* (Makkachikkata). Resident confined to evergreen biotope of hills and nocturnal. Nesting during January-April. (family. Caprimulgidae). The Bourdillon's Eared Nightjar *Eurostopodus macrotis bourdilloni* (Sandgya muzhakkal) Resident inhabiting low country and upto 900 m. Nesting during February-March. The Indian Jungle Nightjar *Caprimulgus indicus indicus* (Ra chuckoo). Resident inhabiting low country, foothills and upto 900 m. Nesting during January-March. The Common Indian Nightjar. *C. asiaticus asiaticus* (Ra chuckoo/Palunga-

palungi). Resident inhabiting low country. Nesting chiefly during February-April and July-August. The Franklin's Nightjar has been reported from Peermade hills but its status and breeding are still to be confirmed.

Order : Apodiformes : The Indian Edible-nest Swiftlet ***Collocalia unicolor*** (Sarappakshi). Resident inhabiting foothills and hills upto 1500 m. Nesting during April-June. The Brownthroated Spinetail Swift ***Chaetura gigantea indica*** (Sarappakshi/Valia modvalan). Resident inhabiting low country and hills upto 1200 m. Nesting during February-April. The White-rumped Spinetail Swift ***C. sylvatica*** (Sarappakshi). Resident inhabiting low country and hills upto 1050 m. Nesting during March-April. The Indian Alpine Swift ***Micropus melba nubifuga*** (Vella varayan sarappakshi). Resident inhabiting hilly areas. Nesting not recorded from Kerala. The House Swift ***Apus affinis*** (Sarappakshi/Ambalamchutti). Resident inhabiting low country. Nesting during February-April. The Palm Swift ***Cypsiurus parvus*** (Sarappakshi/Ambalamchutti). Resident inhabiting low country. Nesting during February-April. The Palm Swift ***Cypsiurus parvus batasiensis*** (Panampakshi, Panamgoolan). Inhabits open country wherever Palmyra palms occur. Nesting during October-April. The Indian Crested Tree Swift **Hemiprocne longipennis coronata** (Sarappakshi). Resident inhabiting foothill country. Nesting December-March.

Order : Trogoniformes : The Malabar Trogon ***Harpactes fasciatus malabaricus*** (Teekakka). Resident inhabiting low country and hills upto 1050 m. Nesting during February-May.

Order : *Coraciiformes* : The Travancore Pied Kingfisher ***Ceryle rudis travancorensis*** (Pulli ponman/Pulli meenkothi). Resident inhabiting low country. Nesting during November-December and March-April. The Common Ceylon Kingfisher ***Alcedo atthis taprobana*** (Poti ponman/Cheriya meenkothi). Resident inhabiting low country. Nesting during November-June. The Blue-eared kingfisher ***A. meninting*** (Poti ponman). Resident inhabiting foothills and upto 1050 m. Nesting probably in January. Though the Threetoed Forest Kingfisher **Ceyx erithacus erithacus** (Meni ponman) has been reported from Kerala, its status and nesting

confirmation. The Brownheaded Storkbillied Kingfisher *Pelargopsis ca pe nsis ca pensis* (Kakka ponman/Kakka meenkothi). Resident inhabiting foothill country. Nesting during January-July. The Indian Whitebreasted Kingfisher *Halcyon smyrnensis fusca* (Ponman/Meenkothi chathan). Resident inhabiting low country and hills upto 1050 m. Nesting during February-April. The Blackcapped Kingfisher H. *pileata* (Ponman). Resident inhabiting coastal low country. Nesting not definitely known from Kerala. (Family. Meropidae). The Chestnut-headed Bee-eater *Merops leschenaulti leschenaulti* (Veli tatta/Chemban velitatta). Resident inhabiting low country and hills upto 1050 m. Nesting during February-March. The Bluetailed Bee-eater M. *philippinus philippinus* (Veli tatta/ Valiya velitatta). This bird is found in Kerala only from September to April near water bodies. The Common/Small Green Bee-eater M. *orientalis orientalis* (Veli tatta/Nattu velitatta). Resident inhabiting low country to about 150 m. Nesting during January-April. Though the bluebearded Bee-eater has been recorded from Kerala, its sttus, breeding etc. need confirmation. The Southern Indian Roller *Coracias benfalensis indica* (Panamkakka). Resident inhabiting low country. Nesting during January-April. The Broadbilled Roller/Dollar Bird *Eurystomus orientalis laetior* (Kattu panamkakka). Its status needs confirmation. It frequents low country and foothills to about 450 m. No definite record on nesting. The Ceylon *Hoopoe Upupa epops ceylonensis* (Uppooppan). Resident inhabiting low country and upto 1500 m.

Nesting during February-April. The Malabar Grey Hornbill *Tockus griseus griseus* (Kozhi vezhambal). Resident inhabiting low country and hills upto abour 1200 m. Nesting during January-April. The Malabar Pied Hornbill *Antharacoceros coronatus coronatus* (Vezhambal/Ponden vezhambal). Resident inhabiting the same type of areas as the previous one. No definite information on nesting. The Great Indian Hornbill *Buceros bicornis homrai* (Malamuzhalkki/Vezhambal/Kompan vezhambal). Resident inhabiting evergreen forest biotope of low country and hills upto 1050m. Nesting during February-April. The Grey Hornbill *Tockus birostris* (Nattu-vezhambal). Resident and breeding species in the area of Palghat Gap and other localities in Malabar.

Order : Piciformes : The Ceylon Green Barbet *Megalaima zeylanica zeylanica* (Kuturuvan). Resident inhabiting deciduous low country. Nesting during February-April. The Small Green Barbet *M. viridis* (Chinnakkutturuvan). Resident inhabiting low country and hills upto 750 m. Nesting during December-April. The Malabar Crimson throated Barbet *M. rubricapilla malabarica* (Alkili). Resident inhabiting foothills and upto 1200m. Nesting during January-March. The Crimsonbreasted/Coppersmith Barbet *M. haemacephala indica.* (Chempukotti). Resident inhabiting The Nilgiri Speckled Piculet *Picumnus innominatus malayorum* (Maramkothi/Maramkothi kuruvi). Resident inhabiting hills upto about 1200 m. No record of nesting in Kerala. The Southern Rufous Woodpecker *Micropternus brachyurus jerdonii* (Chempan Maramkothi). Resident inhabiting low country and upto 900 m. Nesting during February-April. The little Scaly-bellied Green Woodpecker *Picus xanthopygaeus* (Maramkothi). Resident inhabiting low country and upto 1200 m. No record of nesting in Kerala. The South Indian Small Yellownaped Woodpecker *P. chlorolophus* chlorigaster (Marmkothi). Resident inhabiting foothills and upto 1200 m. Nesting during January-May. The Malabar Goldenbacked Woodpeacker *Dinopium benghalense tehminae* (Maramkothi/Nattumaramkothi). Resident inhabiting low and foothill country. Nesting during February-March and July-August. The Malabar Golenbacked Threetoed Woodpecker *D. javanense malabaricum* (Maramkothi) Resident inhabiting low and foothill country and upto 1200 m. Nesting during February-May. The Malabar Great Black Woodpecker *Deyocopus javensis hodgsonii* (Kakka maramkothi). Resident inhabiting fothills and upto 1050 m. Nesting during January-March. The Southern Yellowfronted Pied Woodpecker *Dendrocopos mahrattensis mahratensis* (Maramkothi) Resident inhabiting low country. No record of nesting in Kerala. The Malabar Pigmy Woodpecker *D. nanus cinereigula* (Maramkothi) Resident inhabiting foothills and upto 900 m. Nesting not recorded from Kerala. The Heart-spotted Woodpecker *Hemicircus canente canente* (Pulli maramkothi). Resident inhabiting foothills and upto 1350 m. Nesting November-April. The Blackbacked Woodpecker *Chrysocolaptes festivus festivus* (Maramkothi/Varayanthondakkaruppan). Resident inhabiting low country. Nesting during December—March. Malherbe's

Goldenbacked Woodpecker *C. lucidus chersonesus* (Varayankattu maramkothi/Maramkothi). Resident inhabiting foothills and upto 1850 m. Nesting not recorded from Kerala.

Order : Passeriformes : The Indian Pitta *Pitta brachyura brachyura* (Kavi). Mainly terrestrial found in low country and upto 1500 m. Winter visitor. The Ceylon Bush-lark *Mirafra assamica affinis* (Chempanpati). Resident inhabiting low country. Nesting during March-May. The Ashycrowned, Black-bellied Finch-lark *Eremopterix grisea* (Karimpanti, Karivalayan vanambadi). Resident inhabiting dry low country. Nesting during November-April. The Rufous Short-toed Lark *Calandrella cinerea dukhunensis* (Kottakkuruvi, Koottappati). Winter visitor frequenting dry coastal low country. The Malabar Crested Lark *Galerida malabarica* (Kompan Vanampati Resident inhabiting low country and hills upto 1800 m. Nesting during January-April. The Syke's Crested Lark *G. deva* (Kompan vanampati-vatakkan) is listed by Neelakantan under birds of Kerala. The Small Nilgiri Skylark *Alauda gulgula australis* (Vanampatikkili). Resident inhabiting low country and hills upto 1200 m. Nesting during November-May. The Dusky Crag Martin *Hirundo concolor concolor* (Katrikeppakshi). Resident inhabiting low country and hills upto 1500 m. Nesting during February-March. The Eastern Swallow *H. rustica gutturalis* (Vayalkoti). Winter visitor frequenting low country especially coastal belt. The Nilgiri House Swallow *H. tahitica domicola* (Kanakatrikkilli). Resident inhabiting hills above 900 m. Nesting during March-May. The Sykes s Striated, Redrumped Swallow *H. daurica erythropygia* (Varayankatrika). Resident inhabiting low country. Nesting during February-April. The Baybacked Shrike *Lanius vittatus vittattus* (Asurakkili). Resident inhabiting low country. Nesting. during February-April. The Southern Greybacked Shrike *L. schach caniceps* (Charakkuttan). Resident inhabiting low country and hills upto 1200 m. Nesting during March-May. The Brown Shrike *L. cristatus cristatus* (Asurachinnan). Winter visitor frequenting low country and hills upto 2150 m. (Family. Oriolidae). The Indian Oriole *Oriolus oriolus kundoo* (manjakkili). The status and breeding of this bird in Kerala needs confirmation.

The Indian Blacknaped Oriole *O. chinensis diffusus* (Manjakili). Winter visitor frequenting low country and upto 450 m. The South Indian Black-headed Oriole *O. xanthornus maderaspatanus* (Manjakkaruppan). Resident inhabiting low country. According to Neelakantan Manjakkaruppan nests during March-August. The Black Drongo *Dicrurus adsimilis macrocercus* (Anaranchi, Kakkatampuratti). Resident inhabiting low country. Nesting during March-July. The Indian Grey Drongo *D. leucophaeus longicaudatus* (Kakkatampuran). Winter visitor frequenting low country and hills upto 1700 m. The Whitebellied Drongo *D. caerulescens caserulecens* (Kakkarajan, Kakkaraj). Resident inhabiting low country and upto about 1050 m. Nesting during March-June. The Bronzed Drongo *S. aeneus aeneus* (Lalitakakke Resident inhabiting low country and upto about 1050 m. Nesting during February-April. The Haircrested/Spangled Drongo *D. hottentottus hottentottus* (Kinnarikakka). Resident inhabiting low country and upto about 900 m. Nesting during February-June.

The Large Racket-tailed Drongo *D. paradiseus paradiseus* (Katumuzhakki). Resident inhabiting low country and upto about 1200 m. Nesting during February-May. (Family. Artamidae) The Ashy Swallow Shrike *Artamus fuscus* (Enakkattevan). Resident inhabiting low country. Nesting during April-June. The Grey-headed Myna *Sturnus malabaricus malabaricus* (Charakkali). Winter visitor. The Blyth's Myna *S. malabaricus blythii* (Charakkali). Resident frequenting forest plantations and neighbourhood of cultivation in low country and foot-hills. Nesting during February-April. The Blackheaded-/Brahminy Myna *S. pagodarum* (Karimthalachikkali). Resident inhabiting low country. Nesting during February-March. The Rosy Pastor *S. roseus* (Pandikkali). Winter visitor frequenting low country and hills. The Common Myna *Acridotheres tristis tristis* (Matatta, Kavalamkali). Resident inhabiting low country. Nesting during January-August. The Southern Jungle Myna *A. fuscus mahrattensis* (Kinna ri mynah). Resident inhabiting low country and hills upto 1500 m. Nesting during February-May.. The Southern Grackle *Gracula religiosa indica* (Kattu-mynah). Resident inhabiting low country and hills upto 1500m.

Nesting during February-May. The Tree Pie *Dendrocitta vagabunda parvula* (Olanjali). Resident inhabiting low country. Nesting during March-April. The Southern Tree Pie *D. leucogastra* (Kattunjali). Resident inhabiting foothills and upto 1050 m. Nesting during February-April. The Ceylon House Crow *Corvus splendens protegatus* (Kakka/Paena kakka). Resident inhabiting low country. Nesting chiefly during December-May. The Indian Jungle Crow *C. macrorhynchos culminatus* (Ballikakka/Vellikakka/Thonnankakka). Resident inhabiting low country and upto 900 m. Nesting during April-June. (Family. Campephagidae). The Blackbacked Pied Flycatcher-shrike *Hemipus picatus picatus* (Asurapottan). Resident inhabiting evergreen and moist deciduous biotope chiefly between 150 and 1050 m. Nesting during March-May. The Malabar Wood Shrike *Tephrodornis virgatus sylvicola* (Asurakkatan). Resident inhabiting low country and hills upto 1200 m. Nesting during December-June. The Indian Common Wood Shrike *T. pondicerianus pondicerianus* (Asurattan). Resident inhabiting low country and upto 450 m. The Large Indian Cuckoo Shrike *Coracina novaehollandiae macei* (Charappoondan). Resident inhabiting low country. Nesting during May-October. The Blackheaded Cuckoo Shrike *C. melanoptera sykesi* (Karimtoppi). Resident inhabiting low country and upto about 1050 m. Nesting during March-May. The Orange Minivet *Pericrocotus flammeus flammeus* (Teekkuruvi). Resident inhabiting low country and upto 1200 m. Nesting season not definitely known from Kerala. The Malabar Small Minivet *P. cinnamomeus malabaricus* (Teechinnan). Resident inhabiting low country. Nesting during February-August. (Family. Irenidae). The Ceylon Iora *Aegithinatiphia multicolor* (Iora/Dadi-dee). Resident inhabiting low country and upto about 1050 m. Nesting during January-June. The Goldenfronted Chloropsis/Leaf-bird *Chloropsis surifrons insularis* (Ila kkili/Kattilakkili). Resident inhabiting low country and upto 1050 m. Nesting during November-March. The Jerdon's Chloropsis/Leaf-bird *C. cochinchinensis jerdoni* (Ilakkili). Resident inhabiting low country and upto 1050 m. Nesting during November-June. The Fairy Bluebird *Irena puella puella* (Lalita). Resident inhabiting evergreen biotope low country and upto the highest sholas. Nesting during January-June. The Grey-headed Bulbul *Pycnonotus priocephalus* (Prakuruvi).

Resident inhabiting evergreen biotope of low country and hills upto about 900 m. Nesting during March—May. The Ruby-throated Bulbul *P. melanicterus gularis* (Manikantan). Resident inhabiting evergreen biotope of low country and upto 900 m. Nesting during November-March. The Southern Red whiskered Bulbul *P. jacosus fuscicaudatus* (Irattattalachi). Resident inhabiting evergreen and deciduous biotope of low country and upto 1500 m. Nesting during December-May. The South Indian Redvented Bulbul *P. cafer cafer* (Nattu bulbul). Resident inhabiting deciduous low country and hills upto 600 m. Nesting during March-June. The Whitebrowed Bulbul *P. luteolus luteolus* (Tavitan bulbul). Resident inhabiting deciduous low country. Nesting during February-April. The Yellowbrowed Bulbul Resident inhabiting evergreen biotope of low country. Nesting during February-April. The South Indian Black Bulbul *H. madagascariensis ganeesa* (Mynah bulbul). Resident inhabiting evergreen biotope of hills upto 2530 m. Nesting during March-June. (Family. Muscicapidae) The Travancore Spotted Babbler *Pelloreneum ruficeps olivaceum* (Ganaraj). Resident inhabiting deciduous and evergreen biotope of low country and hills upto 1850 m. Nesting during November-May. The Travancore Scimitar Babbler *Pomatorhinus schisticeps travancorensis* (Cholakkutuvan). Resident inhabiting evergreen and moist deciduous low country and hills upto 2250 m. Nesting during November-May. The White-throated Babbler *Dumetia hyperythra albogularis* (Chinna chilappan). Resident inhabiting scrub jungles between 300 and 900 m. Nesting during April November. The Bourdillon's Black-headed Babbler *Rhopocichla atriceps bourdilloni* (Potichilappan). Resident inhabiting evergreen biotope of low country and hills upto 1850 m. Nesting during April-July. The Common Babbler *Turdoides caudatus caudatus* (Chilappan). Resident inhabiting dry, open, sparsely scrubbed country. Nesting not recorded in Kerala. The Rufous Babbler *T. subrufus hyperythrus* (Chenchilappan). Resident inhabiting semi-evergreen or moist deciduous biotope of low country and hills upto 1050 m. Nesting chiefly during February-May. The Malabar Jungle Babbler *T. striatus malabaricus* (Kariyilakkili). Resident inhabiting mixed deciduous bamboo forest and scrub jungle of low country and upto 900 m. Nesting during January-March. The Whiteheaded Babbler *T. affinis affinis (Kariyila-*

kkili/Poothangeeri). Resident inhabiting low country and foot-hills upto 300 m. Nesting during March-July. The Wynaad Laughing Thrush *Garrulax delesserti delesserti* (Patungan kili). Resident inhabiting low country and rain forest areas upto 1500 m. Nesting during the Southwest monsoon period. The Travancore Whitebreasted Laughing Thrush *G. jerdoni fairbanki* (Chiluchilappan). Resident inhabiting evergreen biotope of hills between 1050 m. and the highest sholas. Nesting during February-May. The Blanford's/South Travancore Laughing Thrush *G. j. meridionale* (Chiluchilappan). Resident inhabiting evergreen biotope of hills above 1050 m. Nesting during February-May. The Nilgiri Quaker Babbler *Alcippe-poioicephala poioicephala* (Kana chilappan). Resident inhabiting low country and upto the highest sholas. Nesting chiefly between January and May. The Brown Flycatcher *Alseonax latirostris* (Thavittupakki). Winter visitor frequenting low country and hills upto 1050 m. The Layard's/Indian Brownbreasted Flycatcher *Musciacapa muttui muttui* (Muttuppilla). Winter visitor frequenting low country and hills upto 1050 m. The Rufoustailed Flycatcher *M. ruficauda* (Chempuvalanpakki). Winter visitor frequenting evergreen biotope of hills between 600 and 1050 m. The Eastern Redbreasted Flycatcher *M. parva albicilla* (Pakki kuruvi). Winter visitor. It is very rare and likely to be a straggler. The Black-and-orange Flycatcher *M. nigrorufa* (Menippakki). Resident inhabiting sholas between 900 and 1500 m. Nesting chiefly during March-April. The Whitebellied Blue Flycatcher *M. pallipes* (Kattuneeli). Resident inhabiting evergreen biotope between 150 and 1050 m. Nesting during February-September. The Bluethroated Flycatcher *M. rubeculoides rubeculoides* (Neelachempan) Winter visitor frequenting evergreen and moist deciduous low country and upto 900 m. The Tickelle's Blue Flycatcher *M. tickelliae tickelliae* Neelakkuruvi). Resident inhabiting moist deciduous low country and upto 1500 m. in the hills. The Verditer Flycatcher *M. thalassina thalassina* (Neelameni). Winter visitor frequenting low country and hills upto 1050 m. The Nilgiri Verditer Flycatcher *M. albicaudata* (Neelakkili). Resident inhabiting evergreen biotope of hills between 900 and 1500 m. Nesting during March-May. The status and breeding of The Greyheaded Flycatcher *Culicicapa Ceylonensis ceylonensis* (Narayanapakki)

in Kerala need confirmation. The Southern Whitebrowed Fantail Flycatcher *Rhipidura aureola compressirostris* (Attakkaran). Resident inhabiting deciduous low country. Nesting during February-May. The Paradise Flycatcher *Terpsiphone paradisi* (Nakamohan). Winter visitor frequenting low country and hills upto 450 m. The Indian Blacknaped Blue Flycatcher *Monarcha azurea styani* (Ven-neeli). Resident inhabiting evergreen and moist deciduous low country and hills upto 1050 m. Nesting during March-August. The Redheaded Fantail Warbler *Cisticola exilis erythrocephala* (Nelpottan). Resident inhabiting hills between 900 m. and 1500 m. No record of nesting in Kerala. The Travancore Streaked Fantail Warbler *C. juncidis salimalii* (Potappottan). Resident inhabiting low country and hills upto 1500 m. Nesting during August - March. The Coorg Longtailed/ Wren Warbler *Prinia hodgsonii albogularis* (Talikkuruvi) Resident inhabiting deciduous biotope of low country and hills upto 1500 m. Nesting during April-July. The Nilgiri Longtailed/ Wren Warbler *P. subflava franklinii* (Vayalkuruvi). Resident inhabiting deciduous low country and hills upto 1200 m. Nesting during December-April. The Ashy Longtailed/Wren Warbler *P. socialis socialis* (Katirkuruvi). Resident inhabiting tall grassland on billsides between 450 and 1050 m. Nesting during May-July. The Southern Jungle Longtailed/Wren Warbler *P. sylvatica sylvatica* (Chettikuruvi). Resident inhabiting stony scrub country. Nesting during April-September. The Tailor Bird *Orthotomus sutorius guurata* (Panakkuruvi/Thonaran). Resident inhabiting deciduous biotope of low country and hills upto 1050 m. Nesting during April-June. The Eastern Grasshopper Warbler *Locustella naevia straminea* (Pulkuruvi). Winter visitor frequenting hills above 1050 m. The Broadtailed Grass Warbler *Schoenicola platyura* (Pottakkili). Resident inhabiting grass covered hill sides between 900 and 1500 m. Nesting during March-May. The Thickbilled Warbler *Phragamaticola aedon aedon* (Chundanbheri). Winter visitor frequenting low country and hills upto 1050 m. The Indian Great Reed Warbler *Acrocephalus stentoreus brunnescens* (Kaitakkallan). Resident inhabiting low country areas with densely shrubbed bunds near backwaters. Nesting during August. The Blythis Reed Warbler *A. dumetorum agricola* (Eetapolappan). Winter visitor frequenting low country and

hills upto 2150 m. The paddyfield Warbler *A. agricola agricola* (Patakkuruvi). Probably a winter visitor commonly seen in low country. The Sykes's Tree Warbler *Hippolais caligata rama* (Chinnanbheri). Winter visitor frequenting deciduous low country. The Tickell's Leaf Warbler *Phylloscopus affinis* (Potikuruvi). Winter visitor frequenting hills. The Largebilled Warbler *P. magnirostris* (Potikuruvi). Winter visitor frequenting low country and hills upto 1200 m. The Large Crowned Leaf Warbler *P. occipitalis occipitalis* (Potikuruvi). Winter visitor frequenting evergreen biotope of low country and hills between 900 and 1200 m. The Whitebilled Shortwing *Brachypteryx major albiventris* (Sandhyakkili). Resident inhabiting evergreen biotope of hills 900 m. and 1200 m. The Whitebilled Shortwing *Brachypteryx major albiventris* (Sandhyakili). Resident inhabiting evergreen biotope of hills 900 m. to highest sholas. Nesting during March—June. The Bluethroat *Erithacus svecicus* (Nilakantappakshi). Winter visitor frequenting irrigated paddy fields and such other areas. The Indian Blue Chat *E. brunneus brunneus* (Nilattan) Winter visitor frequenting evergreen biotope in the hills between 600 and 1500 m. The Southern Magpie Robin *Copsychus saularis ceylonensis* (Mannattippeechi/ Mannattipulleh). Resident inhabiting deciduous low country and hills upto 1050 m. Nesting during February—March. The Shama *C. malabaricus malabaricus* (Shamakkili). Resident inhabiting moist deciduous low country. Nesting during April. The Niligiri Pied Bushcat *Saxicola coprata nilgiriensis* (Chutteental kili). Resident inhabiting hills above 900 900 m. Nesting during February—May. The South Indian Blackbaked Robin *Saxicoloides fulicata fulicata* (Kalmannati). Resident inhabiting deciduous biotope of low country. Nesting during December—April. The Blueheaded Rock Thrush *Monticola cinclorhynchus* (Parakkili). Winter visitor frequenting low country and hills upto 1500 m. The Indian Blue Rock Rock Thrush *M. solitarius pandoo* (Parakkili). Winter visitor frequenting low country and hills upto 1500 m. The Malabar Whistling Thrush *Myiophoneus horsfieldii horsfieldii* (Chulakakka). Resident inhabiting foothills and upto 1500 m. Nesting during April—June. The Whitethroated Ground Thrush *Zoothera citrina cyanotus* (Koori kannan kattupulleh/Kozhikkili). Resident inhabiting evergreen and moist deciduous low country

and hills upto 1500 m. Nesting during May—August. The Niligiri Thrush *Z. dauma neilgherriensis* (Kozhikkilipponnan) Frequents hills above 600 m. Status and breeding need confirmation. The Blackcapped Blackbird *Turdus merula nigropileus* (Karimkili). Winter visitor frequenting well wooded areas in evergreen and deciduous biotopes of low country and hills upto 1050 m. The Bourdillon's Blackbird *T. merula bourdilloni* (Karimkili). Resident commonly found in evergreen sholas. This bird is restricted in distribution to the Southern and middle Kerala hills. The Indian Grey Tit *Parus major mahrattarum* (Marappottan). Resident inhabiting scrub and light deciduous low country and hills upto 1050 m. Nesting during February—May. The Travancore Yellowcheeked Tit *P. xanthogenys travancorensis* (Pacha marappottan). Resident inhabiting evergreen and moist deciduous hill forest. Nesting during June—September. The Velvet—fronted Nuthatch *Sitta frontalis frontalis* (Thandan kili). Resident inhabiting evergreen and moist deciduous forest from low country upto the highest sholas. Nesting during January—April. The Yunnan Tree Pipit *Anthus hodgsoni yunnanensis*. Winter visitor frequenting hills above 900 m. The Richard's Pipit *A. novaeseelandiae richardi* (Chatuppan). Winter visitor frequenting swampy grass terrain of low country. The Malay Pipit *A.n. malayensis* (Chatuppan/ Varamban). Resident inhabiting low country and hills upto 1850 m. Nesting during November—May. The Rufous Rock Pipit *A. similis travancoriensis* (Paranirangan). Resident inhabiting hills above 1050 m. Nesting during April—May. The Nilgiri Pipit *A. nilghiriensis* (Pullolian). Resident inhabiting hills between 1050 and 2300 m. The Forest Wagtail *Motacilla indica* (Kattuvalkulukki). Winter visitor frequenting evergreen and deciduous biotope of low country and hills upto 1050 m. The Greyheaded Yellow Wagtail *M. flava thunbergi* (Charattalayan valkulukki). Winter visitor frequenting low country in the neighbourhood of backwaters. The Short—tailed Greyheaded Yellow Wagtail *M. flava simillima*. Winter visitor frequenting low country. The Blueheaded Yellow Wagtail *M. f. beema*. Winter visitor frequenting standing sugarcane fields and areas where paddy stubbles are found. The Grey Wagtail *M. caspica caspica* (Vazhikulukki). Winter visitor frequenting chiefly hills above 300—450 m. The Indian White Wagtail *M. alba*

dukhunensis (Vella valkuluki). Winter visitor frequenting low country and hills. The Large Pied Wagtail *M. maderaspatensis* (Valukunukki pakshi). Resident inhabiting neighbourhood of streams and backwaters in low country and hills upto 1500 m. Nesting during November—February. The Thickbilled Flower—pecker *Dicaeum agile agile* (Ittikkannikkuruvi). Resident inhabiting low country and hills upto 1050 m. Nesting little before the rainy season starts. The Tickell's Flowerpecker *D. erythrorhynchos erythrorhynchos* (Ittikkannikkuruvi). Resident inhabiting deciduous low country. Nesting during February—June. The Niligiri Flower—pecker *D. concolor concolor* (Ittikkannikkuruvi). Resident inhabiting evergreen and moist deciduous biotope of low country and hills upto 1200 m. Nesting during February—May. (Family Nectariniidae). The Indian Purplerumped Sunbird *Nectarinia zeylonica sola* (Manja Tenkili). Resident inhabiting deciduous low country. Nesting during December—April. The Small Sunbird *N. minima* (Cheru tenkili). Resident inhabiting evergreen hills between 300 and 2150 m. The Loten's/Maroonbreasted Sunbird *N. Lotenia hindustanica* (Tenkili/Valiya tenkili) Resident inhabiting moist deciduous biotope of low country and hills upto 600 m. Nesting during January—May. The Indian Purple Sunbird *N. asiatica* (karuppan tenkili). Resident inhabiting deciduous

biotope of low country and hills upto 900 m. Nesting during November. The Little Spider—hunter *Arachnothera longirostris longirostris* (Tenkilimatan). Resident inhabiting evergreen biotope of low country and hills upto 1500 m. Nesting during January—May. The Niligiri White—eye *Zosterops palpebrosa nilgiriensis* (Vellikkanni). Resident inhabiting evergreen sholas between 450 and 2600 m. Nesting during March—May. The Indian House Sparrow *Passer domesticus indicus* (Kuruvi/ Narayanapakshi/Angadi kuruvi). Resident inhabiting low country near human habitation. Nesting practically throughout the year. The Yellowthroated Sparrow *Petronia Xanthocollis xanthocollis* (Manjatali). Resident inhabiting deciduous biotope of low country. Nesting during March—June. The Travancore Baya/Weaver. Bird *Ploceus philippinus travancoreensis* (Attakkuruvi). Resident inhabiting low country. Nesting during May—September. The streeked Weaver Bird *P. manyar flaviceps* (Attakkuruvi, Kayatatta). Resident inhabiting low country near

backwaters. Nesting during February—September. The White—throated Munia *Lonchura malabarica malabarica* (Vayalatta). Resident inhabiting dry low country. Nesting during December—May. The Whitebacked Munia *L. striata striata* (Attakkaruppan). Resident inhabiting deciduous biotope of low country and hills upto 900 m. Nesting during January—August. The Spotted Munia *L. punctulata punctulata* (Chuttiatta). Resident inhabiting deciduous low country. Nesting throughout the year. The Blackheaded Munia *L. malacca malacca* (Attachemban). Resident inhabiting low country. Nesting during June—August. The Common Indian/Hodgson's Rosefinch *Carpodacus erythrinus roseatus.* (Rosakkuruvi). Winter visitor frequenting hills.

CLASS: MAMMALIA:

Evolved from reptiles, this class includes a big assemblage of warm—blooded vertebrates like shrews, bats, cattle, goat, whale, tiger, lion, monkeys, human beings etc. Body is clothed by hairs. Mammals have been so named because of the presence of mammary glands which secrete milk to nurture the young. Except the egglaying mammal (Monotremata—which is not found in our country) all others give birth to young ones, development of the eggs taking place within the mother.

ORDER:INSECTIVORA:

The Pale Hedgehog *Paraechinus micropus nudiventris.* The Grey Musk Shrew *Suncus nurinus viridescens* (Chundeli). These enter houses at dusk in search of insects.

ORDER:CHIROPTERA:

Megachiroptera: mostly fruit eating bats. The Indian Fruit Bat or The Flying Fox *Pteropus giganteus* (Vouval). This is the largest Indian bat, roosting on trees in large numbers. The Small or Short—nosed Fruit Bat *Cynopterus sphinx.* Roost in large numbers on the folded leaves of plantain, palmyra palms etc.

Microchiroptera: Insectivorous small bats. The Indian False Vampire Bat *Megaderma lyra.* As per the Travancore

State Manual (1940) three species of the Horse—shoe Bats have been recorded from Kerala. These are: ***Rhinolophus affinis*** (***luctus?***); ***R. minor*** and ***Hipposiderus bicolor***. The Indian Pipistrelle ***Pipistrellus coromandra***. The smallest and the commonest bat which hide in roofs etc., during day and flies out at dusk occasionally coming into rooms. The Common Yellow Bat ***Scotophilus heathi***. The Tickell's Bat ***Hesperoptenus tickelli***. These two bats are confined to the tropical zone of the Peninsula. As per Travancore State Manual, The Painted Bat ***Kerivoula picta*** has been recorded from Kerala.

ORDER: PRIMATES:

The Slender Loris ***Loris tardigradus*** (Tevangu) are confined to the dense forest and open tree jungle. The Bonnet Macaque ***Macaca radiata*** (Vella manthi, Vellakurangu). The Bonnet Macaques from 'Travancore' area are considered a distinct race —***M.r. diluta***. The Liontailed Macaque ***Macaca silenus*** (Nella manthi/Chingala) inhabits dense evergreen forest between 650 and 1150 m. Chandrasekharan and Moosa (1977) reported that the Nemmara Forest Division was once a well known strong—hold of the Lion—tailed Macaque, but heavy poaching has reduced its number considerably. The Common Langur, Haruman Monkey ***Presbytis entellus*** (Korungoo). The Nilgiri Langur ***P. johni*** (Karimkurangu). The favourite haunt of this monkey is the sholas or dense evergreen forests. This is another monkey subjected to heavy shooting.

ORDER: PHOLIDOTA: The Indian Pangolin ***Manis crassicaudata*** (Eenampeechi/Urumputheeni/Alungu). frequents plains and lower slopes of hills.

ORDER : LAGOMORPHA : The Black-naped Hare ***Lepus nigricollis nigricollis*** (Moilu). Is common in south Indian hill ranges. May live in the neighbourhood of villages and cultivations.

ORDER : RODENTIA : The Five-striped Palm Squirrel ***Funambulus pennanti***; The Three-striped Palm Squirrel ***F. palmarum*** (Annan/Annarkannan). The latter is more predominant in the south. The Dusky-stripped Squirrel ***F. sublineatus sublineatus***, is confined

to the hills and recorded only from elevations of over 670 m. The Large Brown Flying Squirrel Petaurista *Petaurista philippensis* (Paran/Parachathan) inhabits forest areas. The Small Travancore Flying Squirrel *Petinomys fuscocapillus layardi* (Paran) inhabits the forests of Kerala. The Indian Giant Squirrel *Ratufa indica maxima* (Malayannan) is primarily arboreal and is found in forest areas only. The Indian Gerbille *Tatera indica* (Thurappan) is commonly found in cultivated areas of low country. (Family. Muridae) The Common House Rat *Rattus rattus* (Eli) a commensal rat found in houses. The Brown Rat/The Drain Rat *R. norvegicus*, lives in close association with human habitations. The Blandford's Rat *R. blanfordi* lives mostly in forest areas. The Indian Mole Rat The Leser Bandicoot Rat *Bandicota bengalensis* and *B. indica* (Both are called Panni eli in Malayalam) are found in and around human habitations. The former is found in forest areas. The House Mouse *Mus musculus*, lives chiefly in houses but sometimes in gardens and fields in villages and towns. The Indian Field Mouse M. booduga is commonly found in field and forest. The Indian Porcupine Hystrix indica (Mullan panni) frequents rocky hillside. A color race of the Indian Porcupine refer to as the Red Porcupine has been recorded from hill ranges of Kerala.

ORDER : MYSTICETI : The Finner Whale *Balaenoptera physalus* (Thimingalam) According to Travancore State Manual (1940) one large specimen of the Finner whale was stranded at Rajkkamangalam on Kerala coast in 1904 and a smaller one on the Pouvar coast in 1937. Prater (1965) states that two other species of Balaenoptera occur in Indian seas and likely to be stranded in Indian shores are; The Sei Whale *B. borealis* and The Piked or Lesser Rorqual *B. acutorostrata*.

ORDER : ODONTOCETI : The Sperm Whale. According to the Travancore State Manual (1940) a specimen of Kogia (Pigmy sperm whale) was stranded in Kerala coast in 1926.

ORDER : CARNIVORA : The Jackal *Canis aureus* (Kurukkan) is the commonest nocturnal animal living in forests and low lands around towns and villages. The Indian Fox *Vulpus bengalensis* (Kullanari), lives in open country and seldom enters forest. The

Dhole/Indian Wild Dog *Cuon alpinus* (Kattunai/Chen nai) is an essentially forest animal and is not found in open country. The Sloth Bear Melurus ursinus (Puni karadi) is confined to forest tracts. Krishnan who studied these in Mudumalai sanctury states that 'this bear is no longer to be found in many forests where it was known even 25 years ago. The Common Otter *Lutra lutra nair* (Neer nai), is associated with mountain streams and lakes and nests among rocks and hollows beneath roots of trees growing near water's edge. The Smooth Indian Otter *L. perspicillata* (Neer nai) lives by margins of lakes, streams and canals. This is essentially an otter of the low country, but may ascend hill ranges to low elevations. The Clawless Otter *Aonyx cinerea nirnai* frequents the same biotope as the Common Otter. The Nilgiri Marten *Martes gwatkinsi*, keeps to the high ranges and are rarely found below 915 m. The Ratel/Honey Badger *Mellivora capensis* (Tarakaradi) inhabit dry and moist deciduous zones of hilly broken country. (Family. Viverridae). The Malabar Civet *Viverra megaspila civettina* was, according to Prater (1965) 'once very common in the coastal districts of Malabar and Travancore, but at present it appears to be nearing extinction. This frequents wooded plains and adjoining hill slopes. The Small Indian Civet *Viverricula indica* (Meru) inhabits open deciduous forest and scrub jungle. They are also seen near villages. These are kept in houses for 'musk'. The Palm Civet/Toddy Cat *Paradocurus hermaphroditus* (Mara patty/ Mara meru/Mara nai) is a common pest in houses in Kerala living between the roof and ceiling. *P. jerdoni, The Brown Palm* Civet, is confined to hill region above 900 m. rarely entering houses. The Common Mongoose *Herpestes edwardsi* (Keeree) is essentially an animal of open low country. The striped-necked Mongoose *(H. vitticollis* (Chenkeeree) is primarily a forest animal seldom seen around human habitations. The Striped Hyena *Hyaena hyaena* (Kazhutha puli) was reported to be common once in Travancore (Vide Travancore State Manual, 1940) but appears to be rare now. Prefers open country with low hills and ravines. The Tiger Panthera tigris tigris (Kaduva) inhabiting humid evergreen forest, dry open jungle and grassy swamps. This is considered to be an endangered species and is being given protection. The Leopard/Panther *Panthera pardus* (Pulli puli) inhabits forests, open and scrub country. The Leopard

Cat *Felis bengalensis*, primarily inhabit forest regions, but occasionally found near villages. An allied species F. the Rustyspotted Cat F. *rubiginosa* is found in southern India and along the western ghats. The Fishing Cat F. *viverrina* recorded from Malabar coast between Mangalore and Kanyakumari frequenting creeks and backwaters. The Jungle Cat F. *chaus* (Kattu poocha). Usual haunts of this cat are grass land, scrub jungle marshes and river banks.

ORDER : PROBOSCIDEA : The Indian Elephant *Nlephas maximus* (Ana), frequents areas covered with tall forests where the ground is hilly or undulating and where bamboos grow in profusion

ORDER : SIRENIA :The Dugong, Sea-cow *Dugong dugon* (Katalpanni) have been observed on the coast of Malabar. It was once abundant in Gulf of Mannar, but now it is scarce. The flesh of this animal is liked by local people and are caught in large numbers using a special kind of net.

ORDER : ARTIODACTYLA : The Indian Wild Boar *Sus sacrofa* (Kattu panni) lives in grass or scanty bush jungle or open forests. They breed at all seasons. The Indian Chevrotain Mouse Deer *Tragulus meminna*, inhabits forest areas at elevations upto 1850 m. frequenting grass covered rocky hill sides or forest areas where it leads a solitary and restricted life. The Sambar **Cervus unicolor** (Kullay man) inhabits the wooded districts. Preferably near cultivation. Pairing takes place during November-December and young are born in late May or early June. The Chital/Spotted Deer *Axis axis* (Pulli man) is very common in open forests and bamboo jungles at the foot of hills. These prefer regions of grassy forests with shaded streams. The Muntjac/Barking Deer **Muntiacus muntijak malabaricus** (Kattu adu) Travancore State Manual (1940) states that the race that is found in Travancore is **M. m. aureus**. Prater (1965) states various races are recognised over this wide range. The Muntjac of north India is **M. m. vaginalis**.The Southern form is **M. m. aureus**. A third race (**M. m. malabaricus**) is found in Malabar and extends to Ceylon. The Muntjac inhabits thickly wooded hills and are found at elevations of 1500 to 2450 m. The Indian

Bison/The Gaur *Bos gaurus* (Kattu pothu) is essentially a hill animal. The main calving season is probably in September. The Nilgiri Tahr/Nilgiri Ibex *Hemitragus hylocrius*(Mulla alu). The preferred habitat of this, according to Prater, is "the scarps and crags which rise above forest level. Occassionally they graze in those grassy uplands downs so characteristics of the south Indian hills". These are usually found at elevations of 1220 to 1830 m. This animal has been classified as endangered species.

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CLIMATE

General Description :

The State 'Kerala' lies in the extreme southwest of the Indian sub-continent, bordered by Karnataka State in the north, Tamilnadu in the east and by the Arabian sea in the west. It occupies the portion of the sub-continent bounded by latitudes 8° and 13° north and longitudes 75° and 77° east. The inset given in the front piece clearly indicates the position of the State in India.

On the basis of physical features, the State divides itself into three natural divisions, namely, the low-land consisting of the sea--board, the mid-land consisting of the undulating country east of the low-land and the forest clad high land on the extreme east. The hilly or the eastern portion is formed by a southern section of the Western Ghats nearly 560 km. long and is broken by long spurs, extensive ravines, dense forests and tangled jungles full of flora and fauna, rising terrace after terrace, to an elevation of more than 275 k. m. above sea-leavel. It stretches westwards in gentler slopes and gradually widening valleys but broken here and there by isolated low hills. The plains succeed the forest clad up-lands. Intersected by numerous rivers and streams, dotted elsewhere with homesteads or farms, the plains stretch in a succession of gentle undulations towards a line of backwaters on the coast. Between the backwaters and the sea is a narrow and long stretch of sand. It is low and generally swampy and is in several parts liable to be flooded during monsoon inundations. This area receives the drainage of the numerous streams descending from the Ghats.

Wynad is an elevated and exceedingly picturesque mountainous plateau. The average height of the plateau above sea-level is 900 m. and it is generally rugged and has some of the largest mountain peaks in the district. The regions bordering north Wynad which forms the south-eastern portion of the Cannanore district and is a continuation of Mysore plateau run into a chain of low hills of easy slopes covered with bamboo

. forests. The Nilgiri Kunda range just into the sky on the eastern side of the south Wynad Taluk. Kottayam district is noteworthy for its mountains which with their great height and varied configuration present a grand and imposing spectacle. The mountains rise to an elevation of more than 2,500 metres with high plateau in between. The Western Ghats in this district present their highest elevation in Anamudi (2, 817 metres) which is the highest peak in Kerala and the highest in India. next to those of Himalayas.

A unique feature of high land of Palghat district is the great Palghat gap. The gap is a complete opening having a width of 32.2 km. during january and April every year hot land wind rushes from the east into the district through this gap. Similar to this is the Achen Koil gap or the Aryan Kavu pass which is in the Pathanapuram taluk of Quilon district and gives an easy access by rail and road to the adjoining district of Tirunelveli.

Of all the eleven districts of the State, Palghat, Kottayam and Idukki districts have not been bordered by sea on the west and Alleppey by the Western Ghats on the east.

The important rivers and streams of the State which have their origin in the Western Ghats and are lost in the Arabian sea are the following:

1. Manjeswar River
2. Uppala River
3. Shiriya River
4. Kumbala River
5. Mogral River
6. Chandragiri River
7. Kalnad river
8. Bekal River
9. Chittari River
10. Nileswar River
11. Karingote River
12. Kavvayi river
13. Peruvamba River
14. Ramapuram Puzha
15. Kuppam Puzha
16. Valapattanam Puzha
17. Anjarakandi Puzha
18. Ponnayam Puzha
19. Mahe River
20. Kabani river
21. Murat (Kuttiadi) River
22. Korapuzha river
23. Kallayi River
24. Chaliyar (Beypore) River
25. Kadalundi River
26. Pooraparamba River
27. Tirur River
28. Periyar River
29. Chalakudi River
30. Karuvannur River

31. Ponnani river
32. Bharathapuzha River
33. Bhavani River
34. Shiruvani River
35. Moovattupuzha River
36. Manimala River
37. Meenachil River
38. Achenkoil River.
39. Pamba River
40. Kallada River
41. Ithikara River
42. Neyyar River
43. Karamana River
44. Vamanapuram River

Out of the 44 rivers (listed above) flowing through the Kerala State the first 20 rivers belong to the district Cannanore*.

The Ghat runs north to south and acts an eastern boundary of the State west to east the region stretches across a distance of not more than 125 km. As the ridge runs across the southwest monsoon stream it forms an important climatic zone with copious rainfall on the windward side and dry-belt on the lee-side in the east.

* Inclusive of Kasaragod District.

1. Location of Observatories*

The Indian Meteorological Department organised on an all India basis in 1875, is the national agency for providing service in the field of meteorology. The Meteorological Centre at Observatory Hill Trivandrum is entrusted with the issuing weather forecast and adverse weather warning for Kerala, and Lakshadweep. The Meteorological Centre maintains following observatories.

(1) Departmental observatories :

Trivandrum
Trivandrum Airport
Kozhikode
Cochin (Navy)
Cannanore
Alleppey

(ii) Part-time observatories :

Kottayam
Punalur
Palghat
Trichur (co-operative aided)

The data pertaining to Meteorological parameters like pressure, temperature, humidity, wind, rainfall, cloud coverage etc. are collected by the Meteorological Centre at Trivandrum from the above Observatories. The data collected since 1973 and the list of rain gauge stations are given at the end.

The entire State is classified as one meteorological sub-division for climatological purposes. The State is made up of the eleven districts viz., Cannanore, Kozhikode, Palghat, Trichur, Malappuram, Ernakulam, Idukki, Kottayam, Alleppey, Quilon and Trivandrum.

I. Climatic Divisions :

Areas in the State under each climatic pattern based on Koppen's classification are shown in Fig. 1. The climate over the State is of the type-tropical monsoon with seasonally excessive rainfall and hot summer (Am) except over the extremely southern district viz.,Trivandrum where the climate falls under the type-Tropical Savana with seasonally dry and hot summer weather (Aw).

The year may be divided into three seasons. The period from March to the end of May is the hot season. This is followed by the southwest monsoon season which continues till the middle of October. From the middle of October begins the north-east monsoon season which lasts upto the end of February, although the rains associated with the north-east monsoon ceases by December.

The climate is pleasant from September to February. Summer months March to May are uncomfortable due to high temperatures and humidity. The State is extremely humid due to existence of Arabian Sea in the west of it.

II Sea Level Pressure and wind :

The seasonal variation of atmospheric pressure over the State takes place in a systematic manner with maximum presures during January and minimum pressures during May. The pressure gradient over the State generally remains weak except during late summer and in the monsoon season. The total annual range of pressure is less than 5 mb. The total diurnal range of pressure increases from the coast to the inland regions and this is also within about 5 mb. the maximum in the diurnal range of pressure is seen in the month of February when clouding is almost minimum. June and July with maximum clouding have the minimum diurnal range.

In all the seasons, the pressure gradients over the State is in the east-west direction. The pressure decreases from west to east except during the period from about middle of October to beginning of March, when reverse gradient prevails.

The winds over the State are seasonal only in the region of Palghat gap where winds are predominantly from the east in the period from November to March and from west in rest of the year. In other parts of the State flow of wind is mainly governed by differential heating of land and water mass together with mountain wind. Only during July, August and strong monsoon period, prevailing conditions do not permit the diurnal cycle of winds to exist. With these exceptions, winds have westerly componentsduring the day and easterly components during the night throughout the year.

In general winds are quite strong during afternoons when the thermal circulations is best developed and weak during night. Table I gives the monthly mean daily wind speed in km. p. h. for the observatory stations in the State. The predominant wind direction in the morning and evening have also been included in the table.

III Temperature :

Table 2 gives the mean daily maximum and minimum

temperatures. Fig. 2 (a, b, c) and Fig. 3 (a, b, c) show the distribution of mean maximum and mean minimum temperatures respectively for representative months. Fig. 4 and 5 give the extremes of temperatures ever recorded based on data upto 1977 except for few stations.

Day temperatures are more or less uniform over the plains throughout the year except during monsoon months when these temperatures drop down by about 3 to 5°C. Both day and night temperatures are lower over the plateau and at high level stations than over the plain. Day temperatures of coastal places are less than those of interior places.

March is the hottest month with a mean maximum temperature of about 33°C. The highest temperature ever recorded at an individual station is 41.7°C. at Palghat on 26-4-1950 which is about 8°C. higher than the normal for the warmest month.

Mean maximum temperature is minimum in the month of July when the State receives plenty of rainfall and the sky is heavily clouded. It is 28.5°C. for the State as a whole in July, varying from about 28°C. in the north to about 29°C. in the south. The night temperature is minimum in January when clouding is minimum. For the State as a whole it is about 22.5°C. in January, varying from 22°C. in the north to 22.6°C. in the south. The lowest temperature on record at an individual station was 12.9°C. at Punalur on 8th January, 1965.

Maximum temperature rises gradually from July onwards till March. Night temperature starts rising gradually from January onwards till May and it has a secondary minimum in July when the State receives plenty of rain. The increase in maximum temperature in the period from July to March may vary from 3.2°C. to 9.8°C., depending upon the nearness of the sea from the place. Inland stations experience higher maximum temperatures than the coastal stations. From May onwards both the maximum and minimum temperatures start falling, the latter very rapidly while the former slowly. From the beginning of May to end of July the maximum temperatures fall by about

5.5°C. to 2.5°C. whereas the minimum temperature falls by about 2.5°C. to 3.6°C. from May to January.

July and August have the smallest diurnal range of temperature (about 5.3°C) in the State. The diurnal range increases rapidly after the withdrawal of monsoon. During the period from December to March, the diurnal range is of the order of 8.5°C. to 9.5°C., being the greatest in January.

IV Humidity

Table 3 gives the mean relative humidity at 0830 and 1730 hrs. IST for the individual stations of the State. As the State stretches from north to south with the Arabian sea on its west, relative humidity is in general high over the State. In the period January to March afternoon humidities reduce to 60—63 per cent, varying from 35 per cent in the interior to 71 per cent in the coastal area. The diurnal variation in relative humidity during this period is maximum and ranges from 4 to 16 per cent, depending upon the proximity of the sea. the same in the monsoon period rises to about 85 per cent for the State as a whole and diurnal variation in this period is minimum and ranges from 2 to 12 per cent, maritime influence playing most important role in governing this variation.

V Cloudiness :

Minimum cloudiness prevails over the State in the period January to March when the sky remains cloudless for 12 to 13 days per month towards the extremely southern parts of the State. During this period, about 3 oktas of sky remain cloudy in a month, in general, and cloudiness varies from 3.9 oktas of sky towards the northern coast to 2.3 oktas of sky towards interior and southermost part of the State. Mornings are more cloudy than evenings except at the southern most and interior of the State where afternoons are more cloudy than the mornings. During the monsoon season skies are heavily clouded specially during June and July when about 7 oktas of sky remain covered with cloud in a month. On an average, in each of these two months the sky remains overcast for more than 16 days per month and is not generally found clear even for a single day.

In this season, mornings and evenings are equally cloudy. Cloudiness starts decreasing from August and decreases till September. A secondary maxima of cloudness is observed in the State in October when the post monsoon storms of Bay of Bengal and Arabian sea affect the State. Again it decreases from November till January when the cloudiness in the State is minimum.

Table 4 and table 4(a) give the mean monthly 'total cloud' amount and mean number of days with clear and overcast skies at 0830 and 1730 hrs. IST.

For general information, the mean hours of bright sunshine for different months for some observatory stations in the State are indicated in 4(b).

VI Rainfall :

Table 5 gives District-wise and State-wise mean monthly and annual rainfall and number of rainy days. Fig. 6 and 6(a) to 6(d) show the annual and seasonal distribution of rainfall. Distribution of rainfall in north-east season has been divided into two parts, the first part being the same for period October-December and the other part for the period January-March.

The total annual rainfall in the State varies from 380 cm. over the extreme northern parts to about 180 cm. in the southern parts. The south-west monsoon (June-mid October) is the principal rainy season when the State receives about 73 per cent of its annual rainfall. Monsoonal rainfall as percentage of annual rainfall decreases from north to south and varies from 85% in northernmost district of Cannanore to 54% southernmost district of Trivandrum. Rainfall in the north-east monsoon season (mid October to february) and hot weather season (March to May constitute 7—25 and 10 to 20 percent. North-east monsoon rainfall as percentage of annual rainfall increases from north to south and varies from 7 percent in northern-most district of Cannanore to 25 percent in southernmost district of Trivandrum.

Climate

Kozhikode district in which elevation of land gradually increases from the sea-level as it goes east and finally reaches Wynad plateau having the average height of 915 metres receives the maximum amount of rainfall in the State. The rainfall amount in the State decreases towards the south with decrease of height of Western Ghats. The southernmost district of Trivandrum where Western Ghats are nearest to the sea coast and its average height is also least in the State receives minimum amount of rainfall. The thunderstorm rains in the pre-monsoon months of April and May and that of months are locally known as 'EDAVAPPATHI'. Rainfall during north-east monsoon season is known as 'THULA VARSHAM' in local language.

The southwest monsoon sets over the southern parts of the State by about 1st June and extends over the entire State by 5th June. June and July are the rainiest months, each accounting individually to about 23 per cent of annual rainfall. In each of these months number of rainy days (with daily rainfall of at least 2.5 mm.) varies from 27 towards the north to 15 towards the south. South-west monsoon withdraws from the State by 15th October. Table 6 gives the monthly and annual rainfall for various river catchments in the State.

VII *Rainfall Variability :*

Co-efficient of variation of rainfall in the three seasons namely, hot season, south-west and north-east monsoon seasons is least over the State, in general. The same for annual rainfall is less than 15 per cent over the northern districts like Cannanore, Calicut and Malappuram and less than 20 per cent over the rest districts of the State. But co-efficent of variation of monsoon rainfall over the State is a little higher and this is evident from the fact that the same for monsoon rainfall is more than 20 per cent over the districts Cannanore, Calicut and Malappuram and less than 30 per cent over the rest of districts of the State. The pattern of variability of rainfall for the monsoon season is similar to that for the annual rainfall. The co-efficient of rainfall variation in individual monsoon months i. e., June, July, August and September is of the order of 30—40 per cent, 30—40 per cent, 40—60 per cent and 50—60 percent respectively.

Rainfall variability in the southern and interior parts of the State is, in general, more.

The co-efficient of rainfall variation in hot season is above 80 per cent over the northern parts of the State and is of the order of 50 percent —80 percent in the southern parts, the same for the period October-December is of the order 40—50%. It is extremely high for the period January—February.

VIII Droughts and Excessive Rainfall ;

Droughts :

Meteorologically, drought over an area or place may be defined as a situation when annual rainfall over the area or place is less than 75 per cent of the normal. It is further classified as 'moderate drought' if rainfall deficit is between 25 and 50 per cent and severe drought' when it is more than 50 per cent.

Areas where frequency of drought as defined above is 20 per cent of the years examined are classfied as 'Drought areas' and areas having occasions more than 40 per cent of the total represent 'chronically drought affected areas'.

During the 50 year period from 1901 to 1950, drought conditions as prevailed over Kerala Pradesh are described below : Probabilities of occurrences of low rainfall are also described.

Out of the 11 districts in the State only the southern-most district Trivandrum experienced moderate drought for 4 years including two consecutive years 1937 and 1938. The probability of occurrence of annual rainfall less than 75 per cent of the normal is about 8 percent i.e., about once in twelve years over the district in the long run. During the 50 year period, there was no severe drought in any district in any year. The State as a whole did not experience any drought condition during the period. The following table shows the district-wise years of moderate drought with lowest percentage of annual rainfall and the year in which it occurred.

Table I

1.	Alleppey	1905	74 per cent
2.	Kozhikode	Nil	...
3.	Cannanore	Nil	...
4.	Ernakulam	1905, 1918 1928, 34	71 per cent in 1934
5.	Kottayam	Nil	...
6.	Idukki	Nil	...
7.	Palghat	1928	73 per cent
8.	Malappuram	Nil	...
9.	Quilon	Nil	...
10.	Trivandrum	1917, 1934 1937—38	(70 percent—1937)
11.	Trichur	1921	75 percent

Excessive Rainfall

It may generally be said that rainfall, sufficiently in excess of the normal is a predominant factor for occurrence of floods, particularly in high rainfall regions. Even with co—efficient of variation of rainfall of 20 per cent or less, these regions are prone to frequent floods. For the purposes of the present description, annual rainfall of 125 per cent more of the normal is considered as excessive rain.

During the 50 year period 1901—50, the district—wise years of excessive rainfall (i.e. annual rainfall of 125 percent or more of normal annual rainfall in increasing order of number of such years with highest percentage of annual rainfall and the year in which it occurred.

The following table gives the district—wise years of excessive rainfall with highest percentage of annual rainfall and the year in which it occurred.

Table II

1.	Cannanore	1924, 1933	127% in 1933
2.	Kozhikode	1907, 1924, 1933	140% in 1924
3.	Palghat	1907, 1924, 1933	157% in 1924
4.	Malappuram	1907, 1924, 1933	149% in 1924
5.	Ernakulam	1924	135% in 1924
6.	Kottayam	1920, 1924, 1933	145% in 1933
7.	Idukki	1901—'07, '23—24, 43	185% in 1904
8.	Trichur	1924, 1933	145% in 1924
9.	Alleppey	1922, 1933	137% in 1933
10.	Quilon	1924, 1929, 1933	140% in 1933
11.	Trivandrum	1912, 1920, 1924 1932, 1933	170% in 1933

From the above table, it may be seen that during the period under consideration, the districts of the State recorded excessive rainfall in 16 years, the maximum amount being 185 percent in 1904 for the district Idukki. Trivandrum had 10 and 5 years respectively, each of Kottayam, Kozhikode, Palghat, Malappuram, Quilon had 3 years and each of other districts had 2 years of such rainfall except Ernakulam which had excessive rainfall only in the year 1924. Of all the districts Trivandrum only recorded such rainfall in two consecutive years 1932, 1933. In the years 1924 and 1933, 10 and 9 districts of the State received excessive rainfall respectively and so, these two years stand out as the rainiest year for the State as a whole. In 1907 about one third of the number of districts viz., four out of 11 recorded such excessive rain. The probability of occurrence of excessive rainfall in the State as a whole is about 4 percent i.e., once in 25 years in the long run.

The heaviest rainfall in 24 hours at any station in the sub—division was 645 mm. on 24th July, 1967. The State of Kerala is blessed with plentiful and fairly assured rainfall.

IX. *Cyclonic storms and Depressions*

The geographical position of the State is such that it mainly experiences the influences of storms and depressions in the months of November and December. Chances of storms and depressions affecting the State in the month of May are very less. During the period from 1891 to 1970, only three storms affected the State in the month of May. Out of them, the two originating in the Arabian Sea in the years 1932 and 1941 crossed the coast near about lat. 11 N. moving in a easterly direction. The other one originating in the Bay of Bengal in the year 1932 crossed the east coast south of Madras, weakened into a depression and continued to move in a easterly direction. The other one originating in the Bay of Bengal in the year 1932 crossed the east coast south of Madras, weakened into a depression and continued to move in a easterly direction. After passing over Kerala State, it again emerged into the Arabian Sea near Mangalore. Most of the Bay storms originating in the area bounded by 10° and 15° N. latitudes and 82° E. and 95°E longitudes, move initially in a north—westerly or northerly direction and then recurve towards the north—east. The whole of the east coast of India, the coastal areas of Bangala Desh and the Arakan Coast of Burma are liable to incidence of storms in this month. A number of them are of severe intensity. In the Arabian Sea, storms of this month move generally north—west towards the coast of Arabia. A few move in a northerly direction towards the Gujarat—Maharashtra coast. The movements of the storms of 1932, 1941 which affected the State were actually far from being normal.

The majority of storms and depressions of the Bay of Bengal originate in the area bounded by 5° N and 13°N latitudes and 82°E and 95°E longitudes. Those which move in a west—north westerly direction, strike the north Tamilnadu and adjoining south Andhra Coast and emerge into the Arabian Sea where they may reintensify or weaken. These bay storms may even strike the north—east coast of Sri Lanka. Storms which originate in the south—east Bay generally move in north north—westerly direction and later recurve towards north—east. During their north easterly course they show a tendency to

weaken and dissipate. In the Arabian Sea the initial movement is north—westerly. Storms which go north of 15°N recurve towards the north—east and strike the north Maharashtra—South Gujarat coast. In October only one storm which originated in the Arabian Sea affected the southern—most part of the State in the year 1930. All the storms which affected the State weather in the months of November and December originated in the Bay of Bengal. The Table 7 shows the numbers of storms and depression affecting the State during the period from 1891 to 1970.

Table I

MEAN WIND SPEED (km. p. h.) AND PREDOMINANT WIND DIRECTION

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Calicut	a	9.4	11.4	12.3	12.6	12.5	9.8	9.2	8.9	8.7	8.8	8.1	8.3	10.0
	M	E	E/NE	NE/E	NE/	NE/E	Var	NW	NW	E	E	E		
	E	W	W	W NW	W/ /NW	W/ NW	W/ NW	NW/ W	NM	NW/ W	W/ NW	W	W	
Cochin	a	8.0	9.3	10.6	10.7	10.9	9.1	9.6	9.9	9.1	7.8	6.7	7.1	9.1
	M	NE/E	NE	NE	NE	NE/E	E/NE	Var	Var	NE/E	NE/E	E/NE	NE/E	
	E	W	W	W	W	W/ NW	W/ NW	NW/ W	NW/ W	NW	W	W	W	
Trivandrum	a	5.1	5.9	6.6	7.8	9.2	9.6	10.9	11.2	10.4	7.3	5.5	4.8	7.9
	M	NE	NE	NE/N	N	N N/ NW	NW/ N	NW	NW/ N	NW/ N	N/ NW	C/NE	NE	
	E	SW	SW	SW	W	NW/ W	NW	NW	NW	NW	NW/ W	SW/ W	SW	

Palghat	a	11.3	9.3	8.5	9.3	11.8	13.0	13.3	13.6	11.9	8.7	7.6	10.9	10.8
	M	E	E	E	W	W	W	W	W	W	W	E	E	
	E	E	E	W/E	W	W	W	W	W	W		E	E	
Alleppey	a	9.3	10.7	12.4	12.3	13.6	12.6	12.0	11.1	10.1	10.4	9.1	8.5	11.0
	M	E	E	E/NE	E/NE	E	NW	NW	NW	NE/ NW	E/NE	E	E	
	E	W/ NW	W	W	NW/ W	NW	NW	NW	NW	NW	W/ NW	W	NW/ W	
Sub Div. Mean		8.6	9.3	10.1	10.5	11.6	10.8	11.0	10.9	10.0	8.6	7.4	7.9	9.8

a: Mean wind speed in Kms. per hour
E: Predominant Wind Direction in the Evening
C: Calm. The next predominant direction is also indicated when calm is mentioned
M: predominant Wind Direction in the Morning
VAR: Variable.

Table 2

MEAN MAXIMUM AND MEAN MINIMUM TEMPERATURE (°C)

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	annual
														Annual
Calicut	Max	31.7	31.9	32.6	32.9	32.5	29.5	28.2	28.7	29.5	30.4	31.1	31.6	30.9
	Min	22.0	23.1	24.7	25.8	25.6	23.8	23.3	23.6	23.7	23.8	23.4	22.2	23.7
Fort Cochin	Max	30.6	30.7	31.3	31.4	30.9	29.0	21.1	28.1	28.3	29.2	29.8	30.3	29.8
	Min	23.2	24.3	25.8	26.0	25.7	24.1	23.7	24.0	24.2	24.2	24.1	23.5	24.4
Trivandrum	Max	31.3	31.7	32.5	32.4	31.6	29.4	29.1	29.4	29.9	29.9	30.1	30.9	30.7
	Min	22.3	22.9	24.2	25.1	25.0	23.6	23.2	23.3	23.3	23.4	23.1	22.5	23.5
Palghat	Max	33.5	35.7	37.4	36.0	33.4	29.3	28.1	28.8	30.3	30.7	31.8	32.1	32.3
	Min	22.3	23.0	24.5	25.3	24.8	23.3	22.6	23.1	23.1	23.4	23.0	22.2	23.4
Alleppey	Max	31.9	31.9	32.6	32.7	31.6	29.5	28.8	28.8	29.4	29.7	30.3	31.4	30.7
	Max	22.6	23.6	24.9	25.5	25.3	23.9	23.3	23.5	23.7	23.8	23.7	22.6	23.9
Sub. Div. Means	Max	31.8	32.4	33.3	33.1	32.0	29.3	28.5	28.8	29.5	30.0	30.6	31.3	30.9
	Min	22.5	23.4	24.8	25.5	25.3	23.7	23.2	23.5	23.6	23.7	23.5	22.6	23.8

Table 3

MEAN RELATIVE HUMIDITY (%)

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Calicut	M	74	76	74	75	81	90	92	92	88	85	80	75	82
	E	63	66	69	71	76	85	89	88	82	78	72	64	75
Fort Cochin	M	68	72	74	75	81	88	89	88	84	83	78	71	79
	E	64	68	70	74	78	84	87	86	84	80	74	66	76
Trivandrum	M	77	79	80	81	84	90	89	88	86	87	80	80	84
	E	63	63	66	73	77	82	81	78	77	80	78	69	74
Palghat	M	67	64	67	77	81	89	92	91	87	85	77	69	79
	E	41	33	38	59	69	82	85	81	73	77	68	50	63
Alleppey	M	74	76	76	78	83	90	91	91	88	85	81	75	82
	E	69	70	71	73	78	85	85	85	82	81	76	68	77

Sub. Div.	M	72	73	74	77	82	89	91	90	86	85	81	74	81
	E	60	60	63	70	76	84	85	83	80	89	74	63	73

M — Morning
E — Evening

Table 4

MEAN CLOUD AMOUNT** (OKTA) AND MEAN NUMBER OF DAYS OF CLEAR AND OVERCAST SKIES AT 0830 HRS. IST

Station		*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Annual*
Calicut	a	5	4	5	2	1	0	0	0	1	0	1	5	2.0
	b	1	1	1	3	7	16	18	12	6	5	3	1	6.2
	c	2.8	2.8	2.8	4.3	5.6	6.9	7.2	6.6	5.7	5.5	4.4	3.3	4.8
Cochin	a	2	1	0	0	0	0	0	0	0	0	0	1	0.3
	b	2	2	3	6	12	19	20	16	10	10	6	3	9.1
	c	3.4	3.7	3.8	5.2	6.3	7.3	7.2	6.9	6.2	6.0	5.2	4.2	5.5

Trivandrum	a	12	12	13	5	2	0	1	1	2	2	4	8	5.2
	b	2	1	2	4	9	15	16	11	7	9	7	4	7.3
	c	2.6	2.3	2.4	4.0	5.4	6.6	6.7	6.1	5.1	5.4	4.7	3.4	4.6
Alleppey	a	0	0	0	0	0	0	0	0	0	0	0	0	0
	b	1	1	1	3	7	13	16	11	7	5	3	1	5.7
	c	3.9	4.2	4.3	5.3	6.5	7.1	7.0	6.6	6.2	6.2	5.3	3.9	5.5
Sub. Div. Mean	a	4.2	4.0	4.2	1.4	0.6	0	0.2	0.2	0.6	0.4	1.2	3.0	1.7
	b	1.2	1.2	1.6	3.6	8.0	15.2	17.6	13.0	7.6	7.0	4.4	2.2	6.9
	c	3.0	3.1	3.1	4.6	5.8	6.9	7.1	6.6	5.8	5.8	4.8	3.5	5.0

** Okta = Unit, equal to area of one eighth of the sky used in specifying cloud amount. For example, 1 okta means ⅛th of sky covered.

a = Days with clear sky
b = Days with sky overcast
c = Mean cloud amount

Table 4(a)

MEAN CLOUD AMOUNT (OKTA) AND MEAN NUMBER OF DAYS OF CLEAR AND OVERCAST SKIES AT 1730 HRS. IST

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Calicut	a	6	4	4	1	1	0	0	0	0	0	1	5	1.8
	b	0	1	1	2	7	16	17	11	6	7	5	1	6.2
	c	2.5	2.7	3.1	4.8	5.7	6.9	7.2	6.7	5.9	6.1	5.1	3.4	5.0
Cochin	a	1	1	1	0	0	0	0	0	0	0	0	0	0.3
	b	2	2	3	8	12	20	20	17	11	13	10	4	10.2
	c	3.2	3.2	3.6	5.3	6.3	7.2	7.2	7.0	6.4	6.7	5.7	4.4	5.5
Trivandrum	a	[illegible]	7	4	1	1	0	0	1	1	1	2	5	2.6
	b	4	3	4	10	12	17	17	12	9	13	11	6	9.8
	c	3.5	3.6	4.3	5.7	6.0	6.6	6.7	5.8	5.6	6.4	5.9	4.3	5.4

Palghat	a	3	3	2	0	0	0	0	0	0	0	0	1	0.7
	b	1	1	1	4	7	14	18	12	9	9	6	2	7.0
	c	2.6	3.0	2.9	5.4	5.8	7.0	7.2	6.7	6.1	6.5	5.3	3.4	5.2
Sub. Div. Mean	a	4.0	3.4	2.8	0.4	0.4	0.0	0.0	0.2	0.2	0.2	0.6	2.4	1.2
	b	1.6	1.6	2.2	5.6	9.0	16.4	17.4	12.6	8.4	9.8	7.4	3.0	7.9
	c	3.1	3.2	3.5	3.4	6.0	6.9	7.0	6.6	6.1	6.4	5.6	3.8	5.3

**Okta = Unit, equal to area of one eighth of the sky used in specifying cloud amount. For example, 1 okta means ⅛th of sky covered.

a = Days with clear sky

b = Days with sky overcast

c = Mean cloud amount.

Table 4 (b)

MEAN NO. OF HOURS OF BRIGHT SUNSHINE PER DAY

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Pattambi	9.6	9.6	9.3	8.4	6.1	3.3	2.8	4.3	6.0	8.1	7.9	9.0	6.8
Kasaragod	9.3	9.4	9.3	8.9	6.5	3.2	2.8	4.2	5.8	8.6	8.0	8.9	6.9
Kayamkulam	9.4	9.5	9.4	8.4	5.9	4.3	4.4	5.1	6.4	8.4	7.5	8.4	7.1
Ollukara	9.2	9.1	9.4	8.3	5.7	3.3	3.1	3.9	5.1	8.2	7.5	8.5	6.6
Trivandrum	8.3	8.5	8.3	6.7	5.9	3.7	4.1	5.3	5.9	5.5	5.9	7.4	6.3

Table 5

MEAN RAINFALL (M M) AND NUMBER OF RAINY DAYS

District	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Alleppey District													
a	29.6	27.2	57.4	130.2	298.0	661.6	545.3	360.3	265.8	332.9	220.5	63.9	2992.7
b	1.6	1.6	3.4	7.2	12.2	23.8	22.8	18.6	14.3	15.	11.1	3.7	135.4

Calicut District													
a	10.4	7.6	20.0	92.4	254.1	944.5	1117.4	599.2	262.4	290.2	163.7	34.2	3798.1
b	0.7	0.4	1.3	5.5	9.9	24.5	27.2	22.0	14.0	12.6	7.5	2.0	127.6
Cannanore District													
a	5.3	4.8	11.2	58.6	200.6	923.0	1063.5	584.7	239.4	218.0	106.0	22.8	3437.9
b	0.4	0.3	0.7	3.4	8.0	24.3	27.5	22.9	14.0	10.7	5.4	1.3	118.9
Ernakulam District													
a	16.8	22.6	51.6	129.5	308.4	796.1	785.3	518.0	293.9	359.7	212.6	54.2	3548.7
b	0.8	1.1	2.9	7.2	12.0	25.1	25.7	21.6	15.1	14.9	9.9	2.7	139.2
Idukki District													
a	32.6	21.7	42.8	109.4	188.5	501.7	614.1	405.0	241.2	284.7	191.0	69.4	2702.1
b	1.9	1.5	2.9	7.7	9.8	19.1	20.0	17.7	13.5	15.1	10.9	4.3	125.4
Kottayam District													
a	28.7	30.3	85.4	176.9	324.1	713.3	657.7	447.5	296.5	383.7	244.7	73.6	3482.4
b	1.6	1.6	4.5	9.5	12.8	24.3	24.2	24.5	14.7	15.7	11.1	3.7	144.2
Malappuram District													
a	6.7	6.5	19.3	78.7	211.0	702.4	787.0	405.0	198.8	290.0	163.8	30.9	2900.1
b	0.5	0.4	1.3	4.6	8.7	23.2	25.6	19.2	12.0	12.9	7.5	1.7	117.6

Quilon District													
a	24.7	32.1	82.9	163.8	265.4	542.3	460.2	315.5	230.1	351.4	247.5	62.9	2778.8
b	1.5	1.8	4.5	8.9	11.5	21.9	21.3	16.9	12.6	15.2	11.1	3.5	130.7
Palghat District													
a	9.7	9.2	26.9	79.3	157.9	503.4	649.9	363.0	169.5	257.2	140.9	29.7	2398.6
b	0.5	0.5	1.5	4.4	7.1	20.6	24.5	18.0	11.0	12.4	6.9	1.5	108.9
Trichur District													
a	10.1	9.2	28.4	91.1	283.5	800.3	747.6	441.7	245.5	305.7	163.5	32.8	3159.4
b	0.5	06	1.6	4.8	10.9	24.8	25.5	20.0	13.3	13.0	7.5	1.6	124.1
Trivandrum District													
a	24.1	18.9	45.7	117.2	201.9	351.1	22.0	149.3	137.6	283.2	213.0	69.9	1833.9
b	1.7	1.2	2.8	6.8	9.0	17.0	14.6	10.0	8.4	12.5	10.3	4.0	98.3
Sub. Div. Mean													
a	18.1	17.3	42.9	11.6	244.9	676.3	695.5	417.2	234.6	305.2	187.9	49.5	3001.0
b	1.1	1.0	2.5	6.4	10.2	22.6	23.5	18.9	13.0	13.6	9.0	2.7	124.5

(a) Normal rainfall
(b) Average number of rainy days (days with rain of 2.5 m. m. or more)

Table 6

RAILFALL (IN MM.) OVER PARTS OF DIFFERENT RIVER BASINS FALLING WITHIN KERALA STATE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
(1) Streams from Cape Comorin to the Tadri exluding the Tadri Catchment: Districts Parts of districts within this. *Kerala State:* Kottayam, Alleppey, Quilon, Ernakulam, Trivandrum, Trichur, Palghat, Kozhikode, Malappuram, Cannanore													
	18.7	19.4	47.2	116.4	249.9	676.5	676.9	418.9	242.5	311.3	193.0		3022.4
(2) River Cauvery: Districts/ parts of districts within this Catchment *Kerala State:* Kottayam, Cannanore, Kozhikode													
	23.9	8.6	23.0	87.6	143.5	574.7	898.9	483.8	207.3	228.5	144.1	48.9	2872.8

Table 7

Depressions/Storms affecting Kerala State during 1891 to 1970

Month	*Kerala State*	*State as a whole*
January	...	...
February	...	...
March	...	...
April	...	...
May	1+1+1	3
June	...	...
July	...	...
August	...	...
September	..	...
October	1	
November	1+2+2+3+3+2	13
December	1+1+1+1	4
	Total	*21*

Table II

LIST OF RAINGAUGE STATIONS IN KERALA STATE
(Reporting Stations)

Name of Station	*Controlling Officer*
	TRIVANDRUM DISTRICT
1. Ponmudi	Manager, Tourist Bungalow, Kallar Bridge
2. Varkala	Senior Physician, Government Ayurveda Hospital
3. Attingal	Tahsildar, Attingal (Chirayinkil)

4. **Nedumangad**	Tahsildar
5. **Trivandrum (b)**	Meteorological-in-charge, (Met. Observatory), Indian Meteorological Department
6. **Parassala**	Medical Officer, Government Hospital
7. **Neyyattinkara**	Tahsildar
8. **Trivandrum Aerodrome**	Officer-in-charge, Trivandrum airport Met. Office
9. **Vellayani**	Farm Superintendent, College Farm, Vellayani
10. **Kovalam**	

QUILON DISTRICT

11. Pathanamthitta	Tahsildar
12. Konni	Divisional Forest Officer
13. Adoor	Tahsildar, Kunnathur
14. Karunagappally	Tahsildar
15. Punalur	Tahsildar, Pathanapuram
16. Kottarakara	Tahsildar
17. Arienkavu	Range Officer
18. Quilon	Junior Engineer, B & R, P. W. D.
19. Nilamel	Block Development Officer, Chadayamangalam
20. Paravoor	Sub Inspector of Police
21. Kayamkulam	Research Assistant, Central Plantation Crops, Research Institute, Regional Station, Kayamkulam, Ochira P. O.

* Indian Meteorological Centre, Trivandrum.

Name of Station	Controlling Officer

KOTTAYAM DISTRICT

22. Vaikom	Junior Engineer, B & R.
23. Pala	Tahsildar
24. Ettumanur	Sub Inspector of Police
25. Kanjirappally	Medical Officer, Government Holspital

26. Kottayam	Executive Engineer, P.W.D., B & R.
27. Changanacherry	Tahsildar
28. Kottayam (Agromet)	Deputy Director (B.O.T.) Rubber Research Institute, Kottayam—9

IDUKKI DISTRICT

29. Chinnar	Preventive Officer, Excise Checking Station
30. Marayur	Ranger
31. Munnar	Junior Engineer, P.W.D. Tourist Bungalow
32. Devicolam	Tahsildar
33. Kumily	Depot Officer
34. Peermade Taluk	Tahsildar
35. Peermade	Residency Superintendent, Kuttikanam Palace
36. Vandanmettu	Village Officer
37. Veloor	Teak Plantation Officer
38. Karikode (Thodupuzha)	Tahsildar

ALLEPPEY DISTRICT

39. Arukutty	Medical Officer, Primary Health Centre
40. Sherthala	Tahsildar
41. Alleppey (b)	Port Officer
42. Ambalapuzha	Sub Treasury Officer
43. Thiruvalla	Tahsildar
44. Chengannur	Tahsildar
45. Haripad	Tahsildar
46. Mavelikara	Tahsildar
47. Kayamkulam	Sub Treasury Officer

ERNAKULAM DISTRICT

48. Malayattur	Divisional Forest Officer
49. Parur	Tahsildar
50. Perumbavoor	Tahsildar, Perumbavoor (Kunnathunadu).

51. Alwaye	Junior Engineer, P.W.D. Section Office (Water Resources Section)
52. Neriyamangalam	Junior Engineer, P.W.D. (B & R)
53. Ernakulam	Tahsildar
54. Muvattupuzha	Tahsildar
55. Cochin (b)	Commanding Officer, I.N.S. Garuda, (Cochin — I)

TRICHUR DISTRICT

56. Cranganore	Tahsildar
57. Mukundapuram (Irinjalakuda)	Tahsildar
58. Trichur	Tahsildar
59. Talappilly (Vadakkancherry)	Tahsildar
60. Ollukkara	Superintendent, Agricultural Research Station
61. Peechi	Research Range Officer
62. Chalakudy	Assistant Engineer, Irrigation Sub Division

PALGHAT DISTRICT

Name of Station	*Controlling Officer*
63. Alathur	Junior Agricultural Officer, State Seed Farm
64. Palghat	Tahsildar
65. Parli	Sub Registrar
66. Ottapalam	Tahsildar
67. Cherplassery	Tahsildar
68. Mannarghat	Forest Range Officer
69. Chittur	Tahsildar
70. Pattambi (Agromet)	Assistant Rice Specialist, Agricultural Research Station

MALAPPURAM

MALAPPURAM DISTRICT

71.	Perintalmanna	Tahsildar
72.	Ponnani	Tahsildar
73.	Manjeri	Tahsildar
74.	Tirurangadi	Sub Registrar
75.	Nilambur	Forest Range Officer
76.	Kozhikode	Tahsildar
77.	Vythiri	Tahsildar. South Wynad
78.	Quilandy	Tahsildar
79.	Badagara	Tahsildar
80.	Kuttiadi	Sub Registrar

CANNANORE DISTRICT

81.	Kasargod	Tahsildar
82.	Taliparamba	Tahsildar
83.	Cannanore	Tahsildar
84.	Hosdurg	Tahsildar
85.	Tellicherry	Tahsildar
86.	Irikkur	Sub Registrar
87.	Payyannur	Sub Registrar
88.	Mahe	Assistant Engineer, B. & R
89	Kasargod (Agromet)	Joint Director, Central Coconut Research Station, Kasargod
90.	Mananthoddy	Tahsildar. North Wynad

List of Non reporting raingauge stations:

	Name of Station	*Controlling Officer*

TRIVANDRUM DISTRICT

1.	Aruvikara	Inspector, Headworks
2.	Vamanapuram	Village Officer, Vamanapuram
3.	Nedumangadu	Block Development Officer

QUILON DISTRICT

4.	Kulathupuzha	Junior Engineer, P. W. D.
5.	Kottarakara	Block Development Officer

KOTTAYAM DISTRICT

6. Kottayam — Tahsildar
7. Pallom — Block Development Officer. Vadavattoor
8. Kumarakom — Superintendent (R.C.R. Station)

ALLEPPEY DISTRICT

9. Alleppey — Tahsildar. Ambalapuzha

ERNAKULAM DISTRICT

10. Puthencruz — Junior Engineer, P. W. D.
11. Kuthattukulam — Junior Engineer, P. W. D.
12. Kolani — Junior Statistical Inspector. Thodupuzha

TRICHUR DISTRICT

13. Pazhayannur — Assistant Engineer. P. W. D.. Cheerakuzhi Scheme

PALGHAT DISTRICT

14. Nenmara — Block Development Officer
15. Nelliampathy — Fieldman. Agricultural Research Station
16. Nattukal — B. D. O. Stage II Block, Chittur

KOZHIKODE DISTRICT

17. Kuttiyadi — Executive Engineer. Construction Division
18. Ambalavayal — Research Assistant. Agricultural Research Station
19. Kuppady — Forest Range Officer. Sultan Battery Range
20. Mettunga — —do—
21. Lakkidi — Junior Engineer. P. W. D.
22. Thagarappady — —do—

CANNANORE DISTRICT

23. Manjeshwar — Block Development Officer

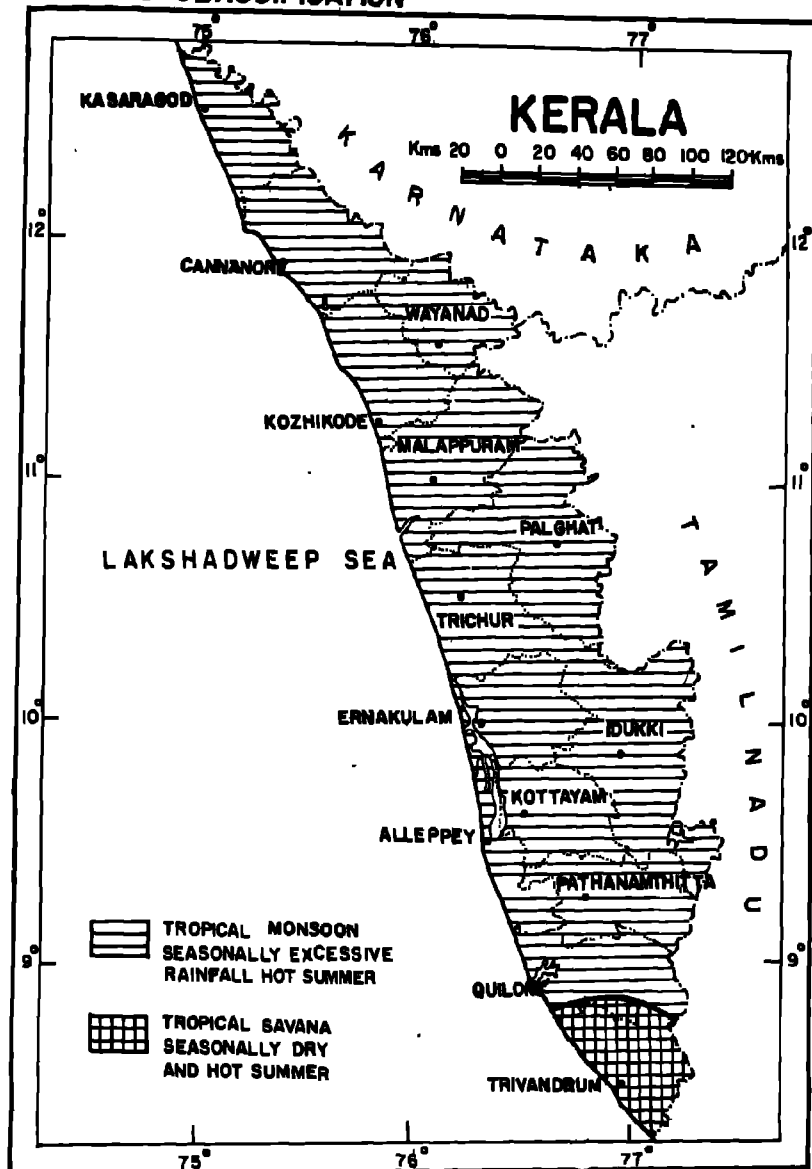
CLIMATIC CLASSIFICATION
KERALA
Kms 20 0 20 40 60 80 100 120 Kms
KARNATAKA
TAMIL NADU
LAKSHADWEEP SEA
KASARAGOD
CANNANORE
WAYANAD
KOZHIKODE
MALAPPURAM
PALGHAT
TRICHUR
ERNAKULAM
IDUKKI
KOTTAYAM
ALLEPPEY
PATHANAMTHITTA
QUILON
TRIVANDRUM
TROPICAL MONSOON SEASONALLY EXCESSIVE RAINFALL HOT SUMMER
TROPICAL SAVANA SEASONALLY DRY AND HOT SUMMER
75°
76°
77°
12°
11°
10°
9°
FIG: I

MEAN MAXIMUM TEMPERATURE (°C) JANUARY

FIG : 2(a)

MEAN MAXIMUM TEMPERATURE (°C) MARCH
KERALA
Kms 20 0 20 40 60 80 100 120Kms
KARNATAKA
TAMIL NADU
LAKSHADWEEP SEA
KASARAGOD
CANNANORE
WAYANAD
KOZHIKODE
MALAPPURAM
PALGHAT
TRICHUR
ERNAKULAM
IDUKKI
KOTTAYAM
ALLEPPY
PATHANAMTHITTA
QUILON
TRIVANDRUM
35
37·5
32·5
75°
76°
77°
12°
11°
10°
9°

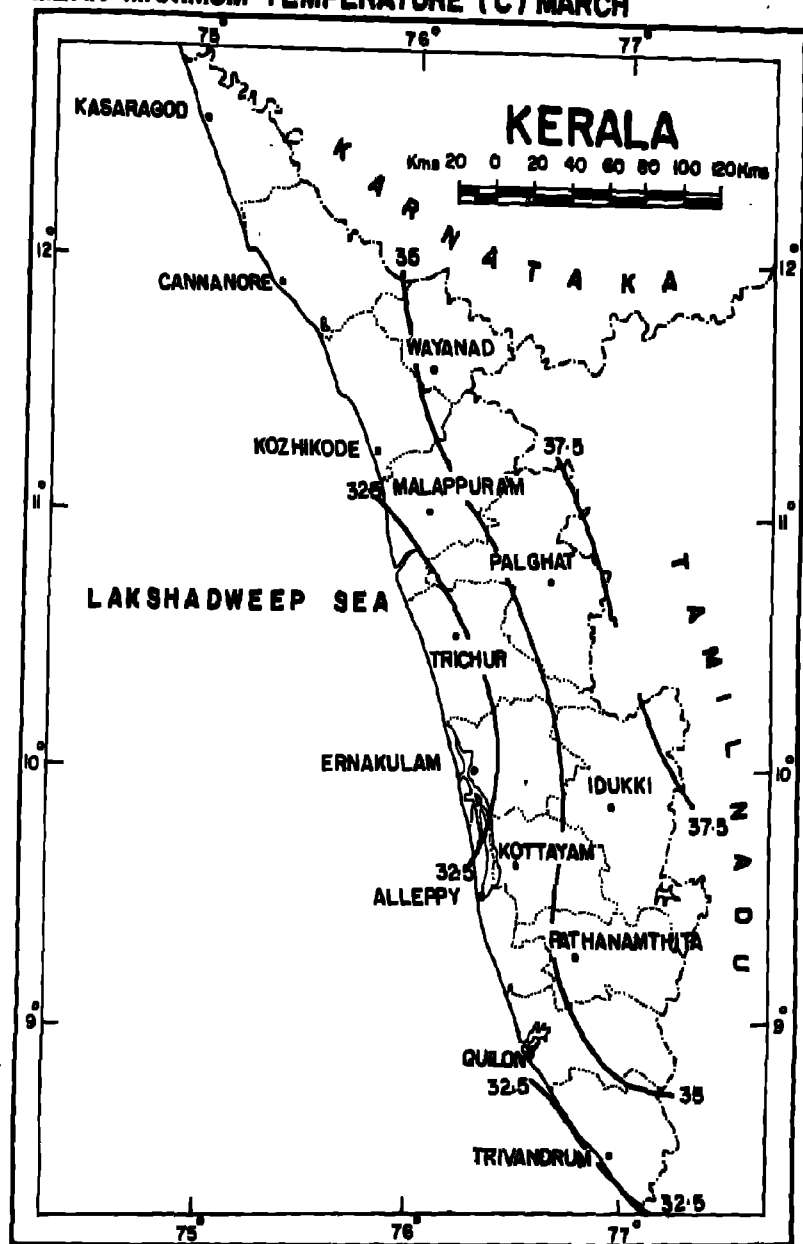



FIG: 2(b)

MEAN MAXIMUM TEMPERATURE (°C) JULY

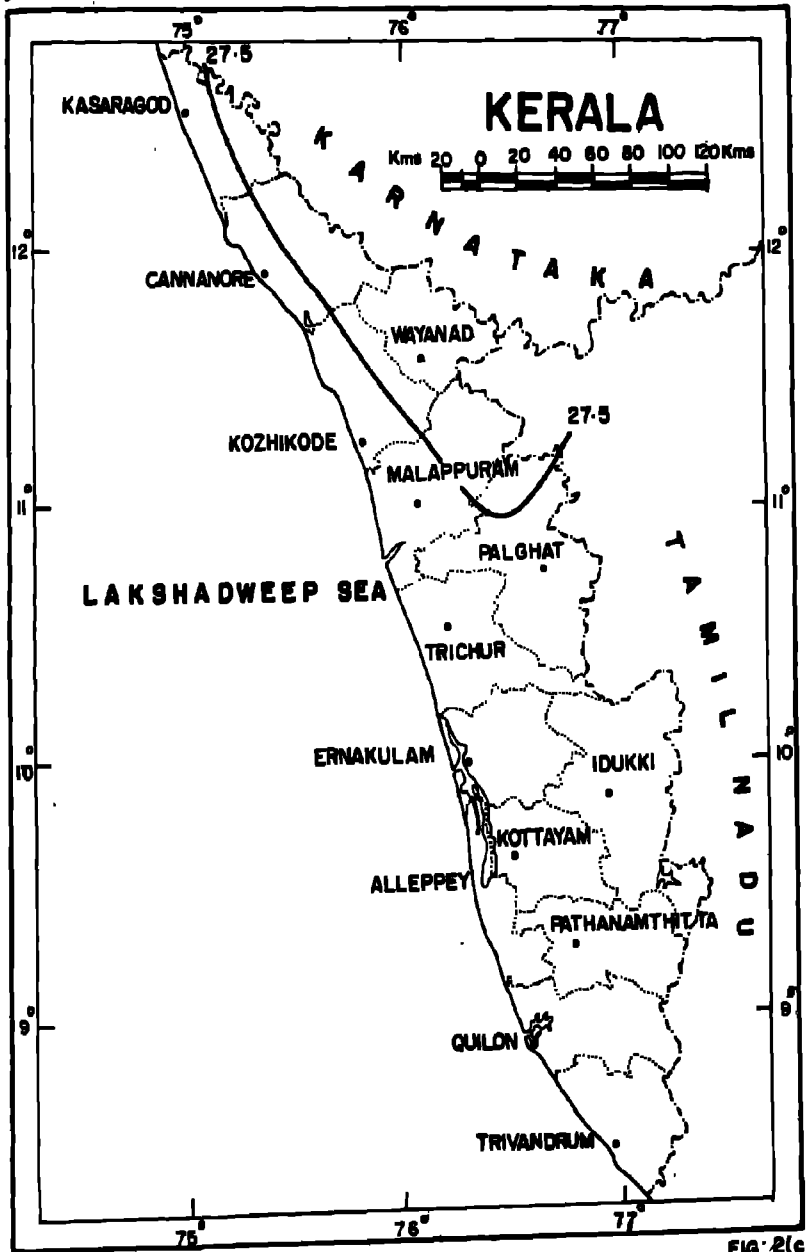



FIG: 2(c).

MEAN MINIMUM TEMPERATURE (°C) JANUARY

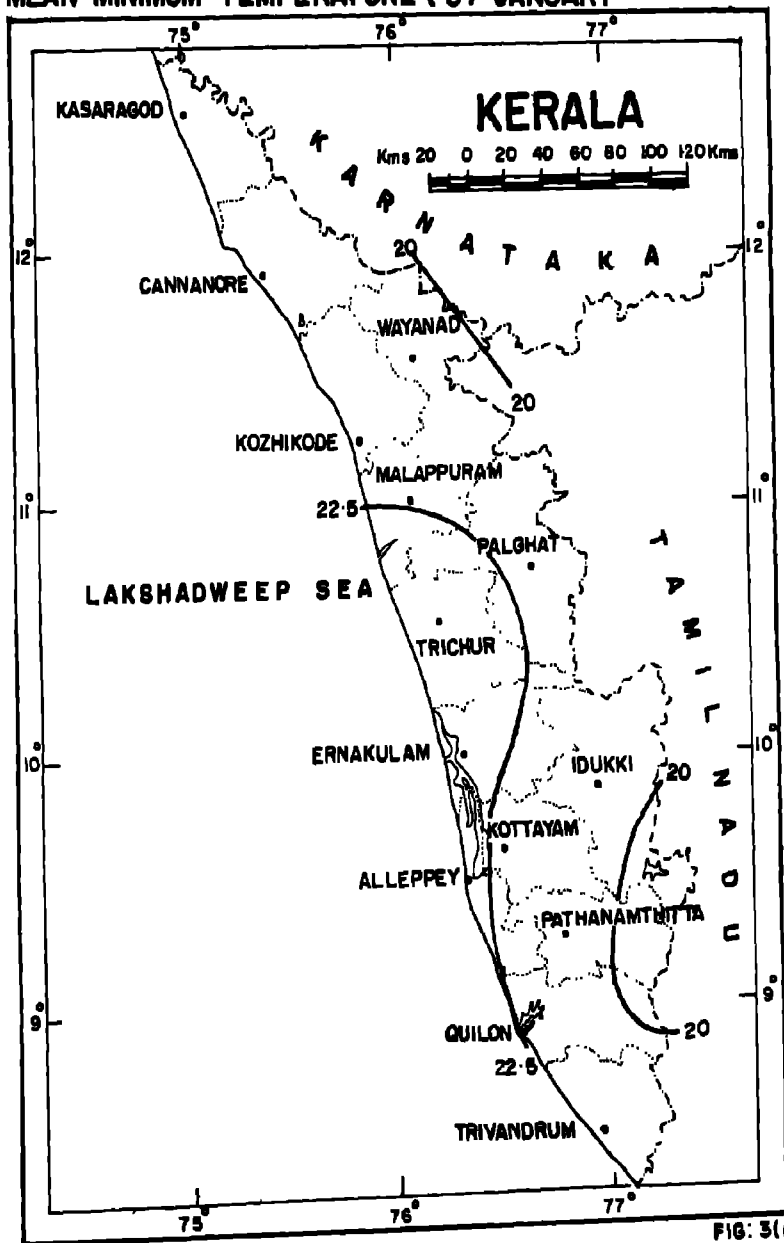



FIG: 3(a)

MEAN MINIMUM TEMPERATURE (°C) MARCH

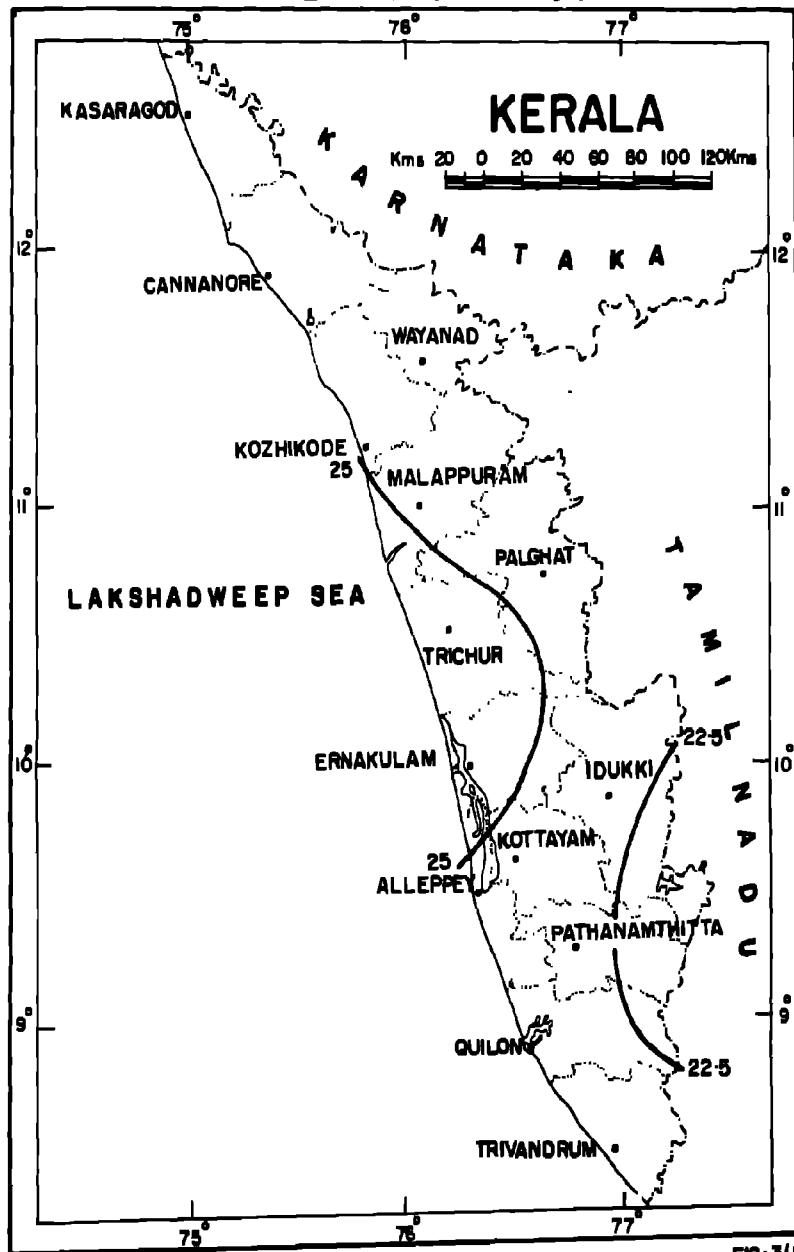
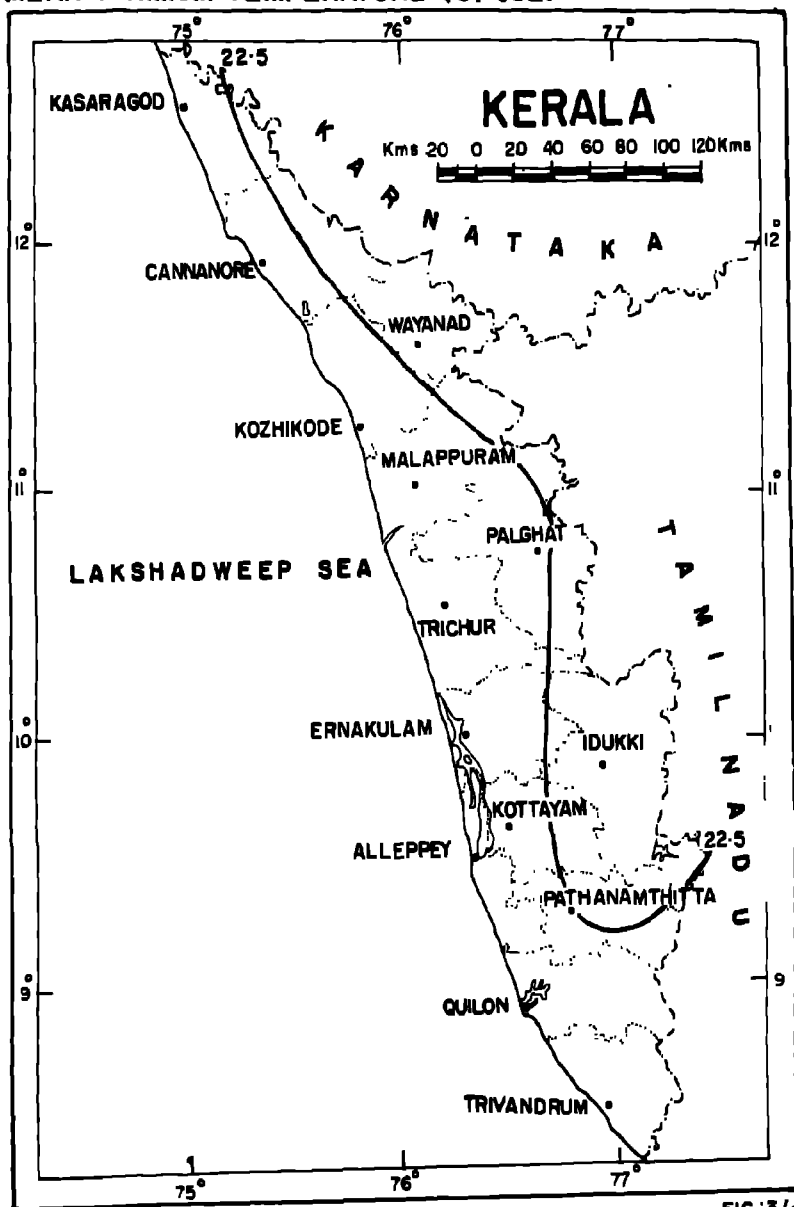



FIG: 3(b)

MEAN MINIMUM TEMPERATURE (°C) JULY

FIG :3 (c)

EC 250-12

HIGHEST MAXIMUM TEMPERATURE (°C) EVER RECORDED

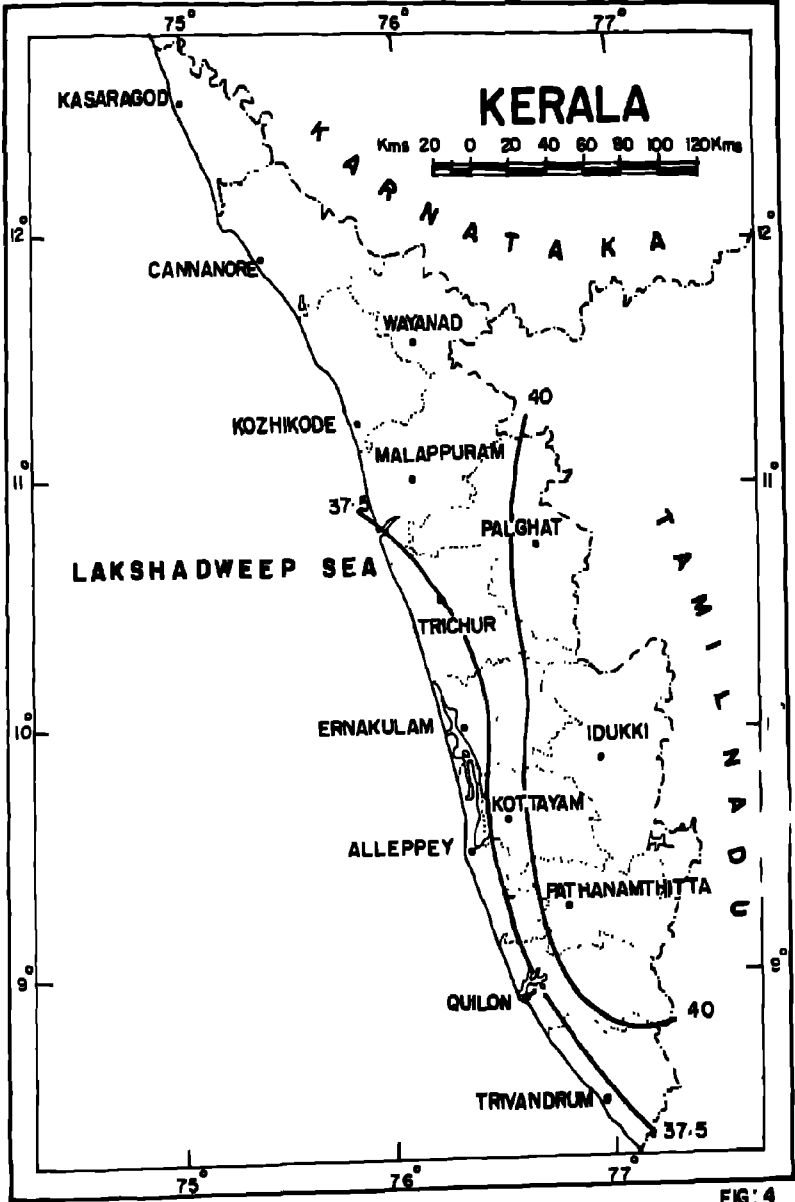



FIG: 4

LOWEST MINIMUM TEMPERATURE (°C) EVER RECORDED

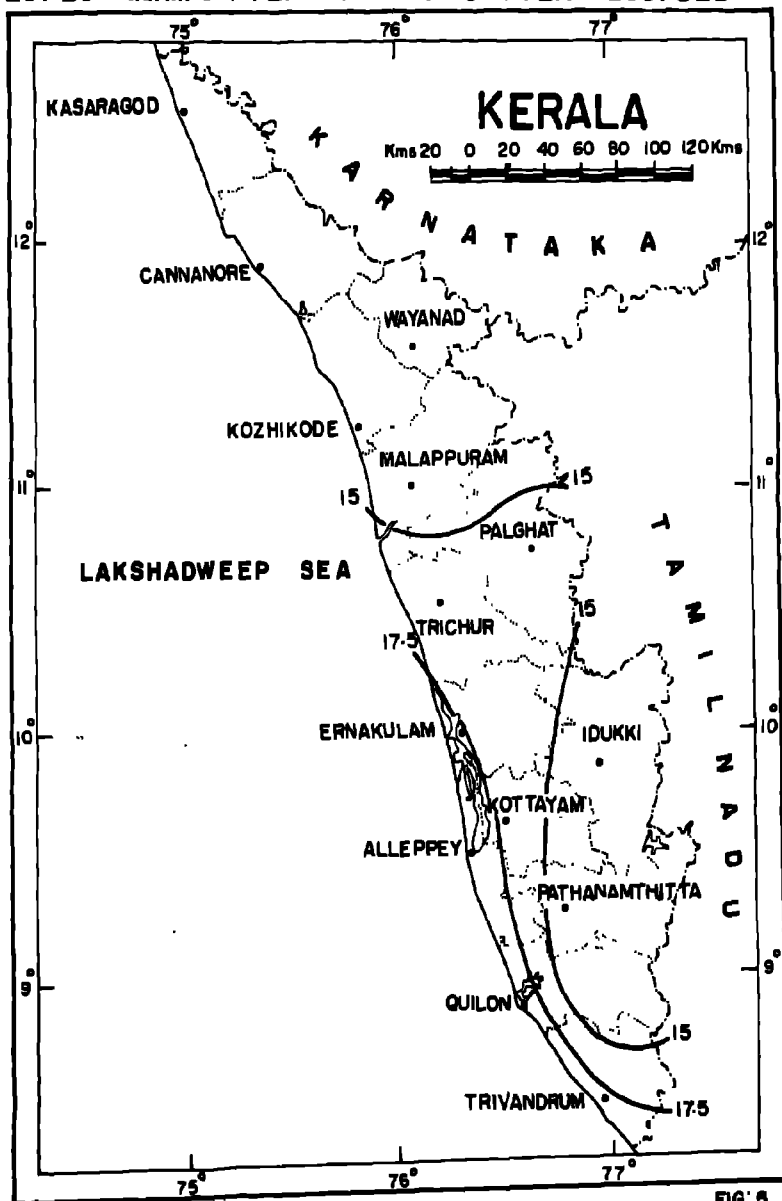



FIG: 5

RAINFALL (cms) ANNUAL

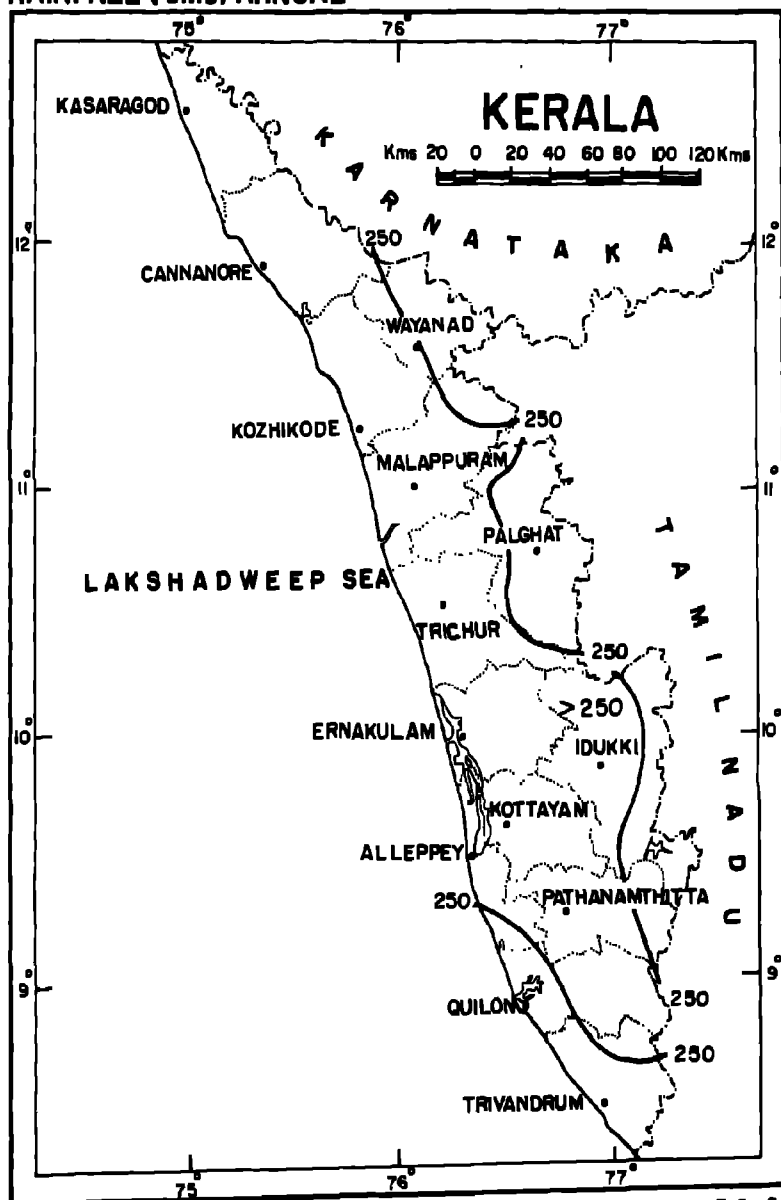



FIG : 6

RAINFALL (cms) JANUARY– FEBRUARY

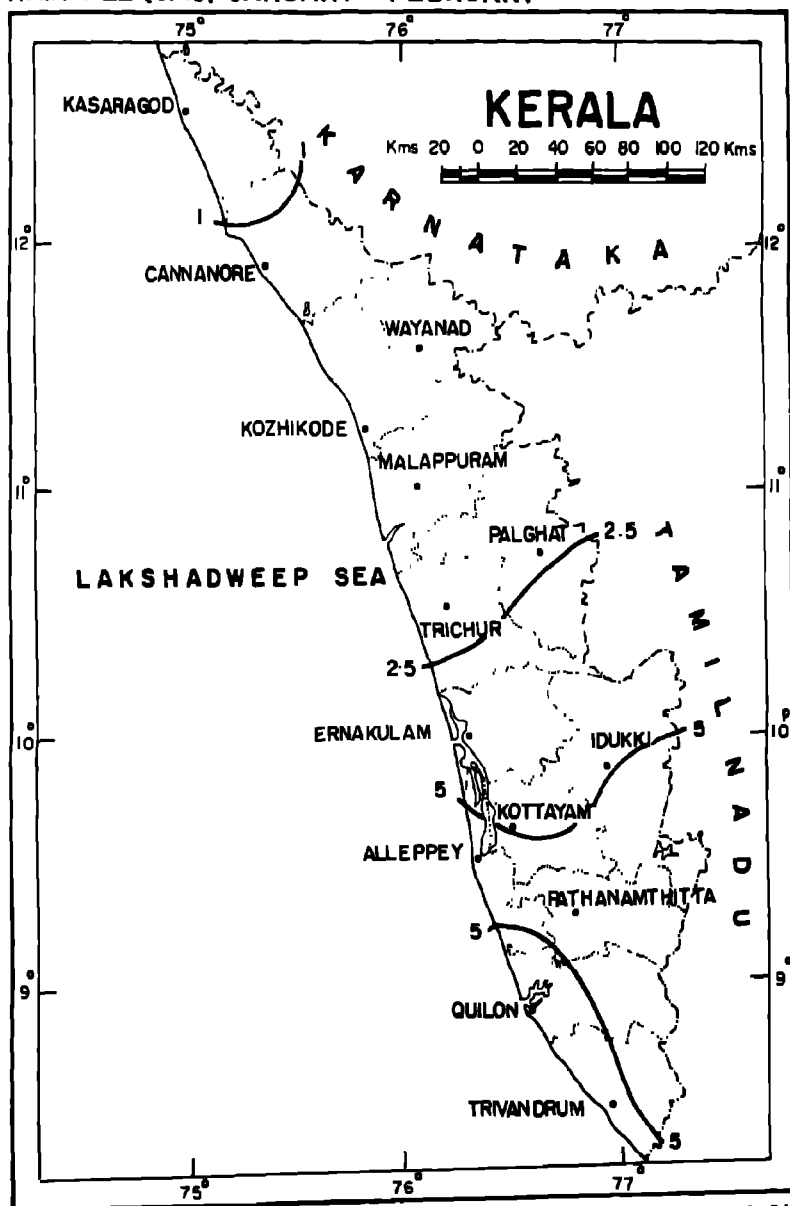



FIG: 6(a)

RAINFALL (cms) MARCH – MAY
KERALA
Kms 20 0 20 40 60 80 100 120 Kms
KARNATAKA
TAMIL NADU
LAKSHADWEEP SEA
KASARAGOD
CANNANORE
WAYANAD
KOZHIKODE
MALAPPURAM
PALGHAT
TRICHUR
ERNAKULAM
IDUKKI
KOTTAYAM
ALLEPPEY
PATHANAMTHITTA
QUILON
TRIVANDRUM
75°
76°
77°
12°
11°
10°
9°
20
30
40
50

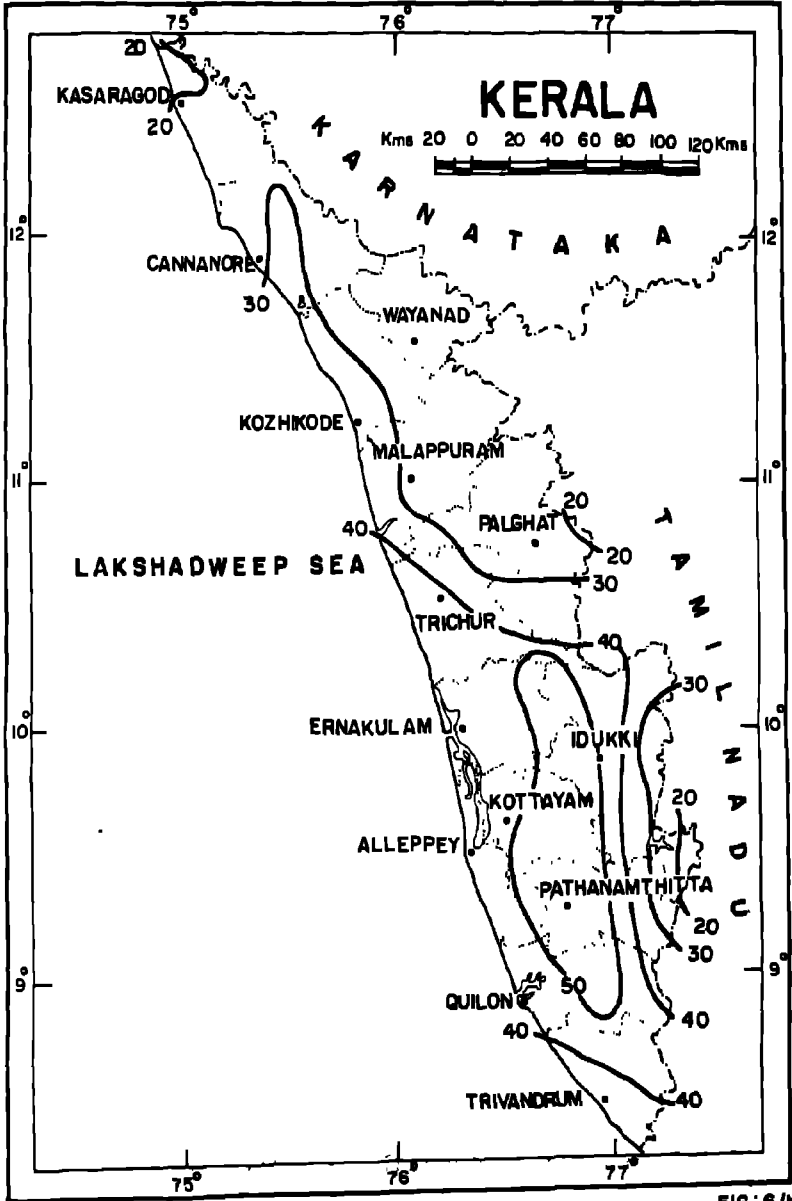



FIG: 6 (b)

RAINFALL (cms) JUNE - SEPTEMBER

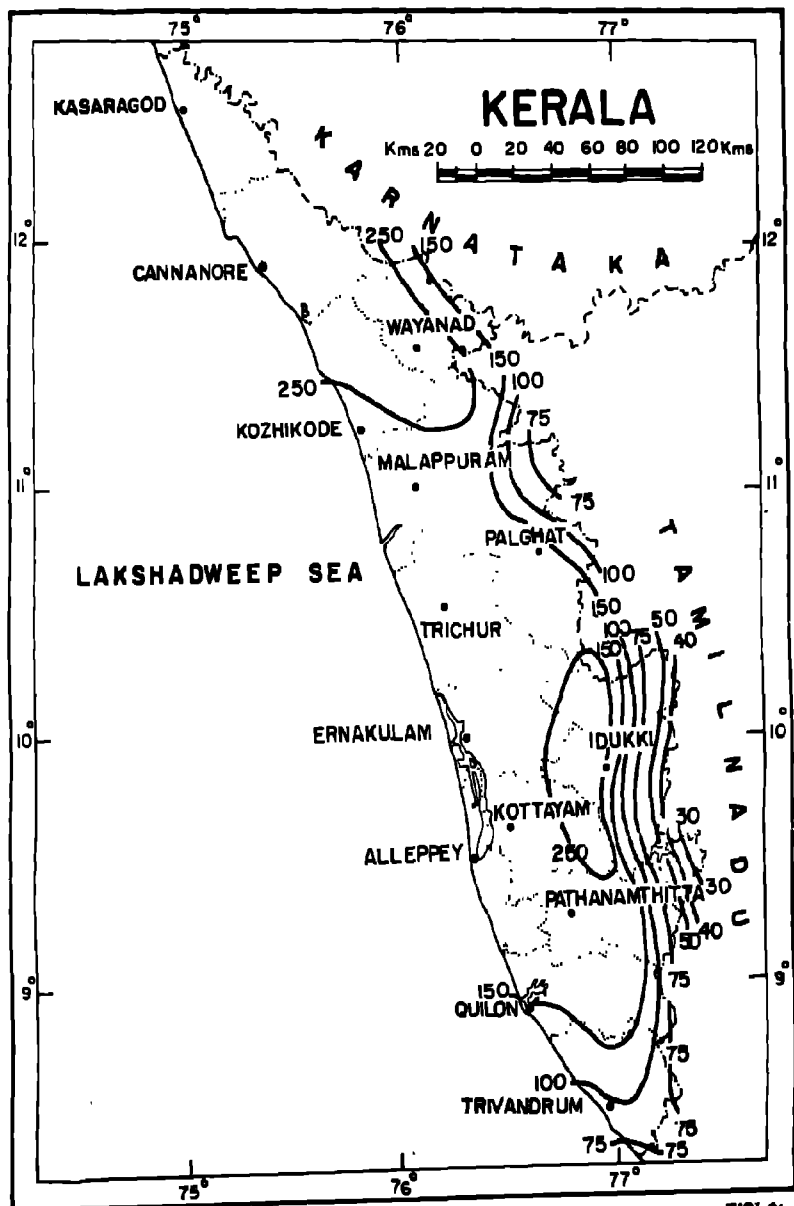



FIG: 6(c)

RAINFALL (cms) OCTOBER _ DECEMBER

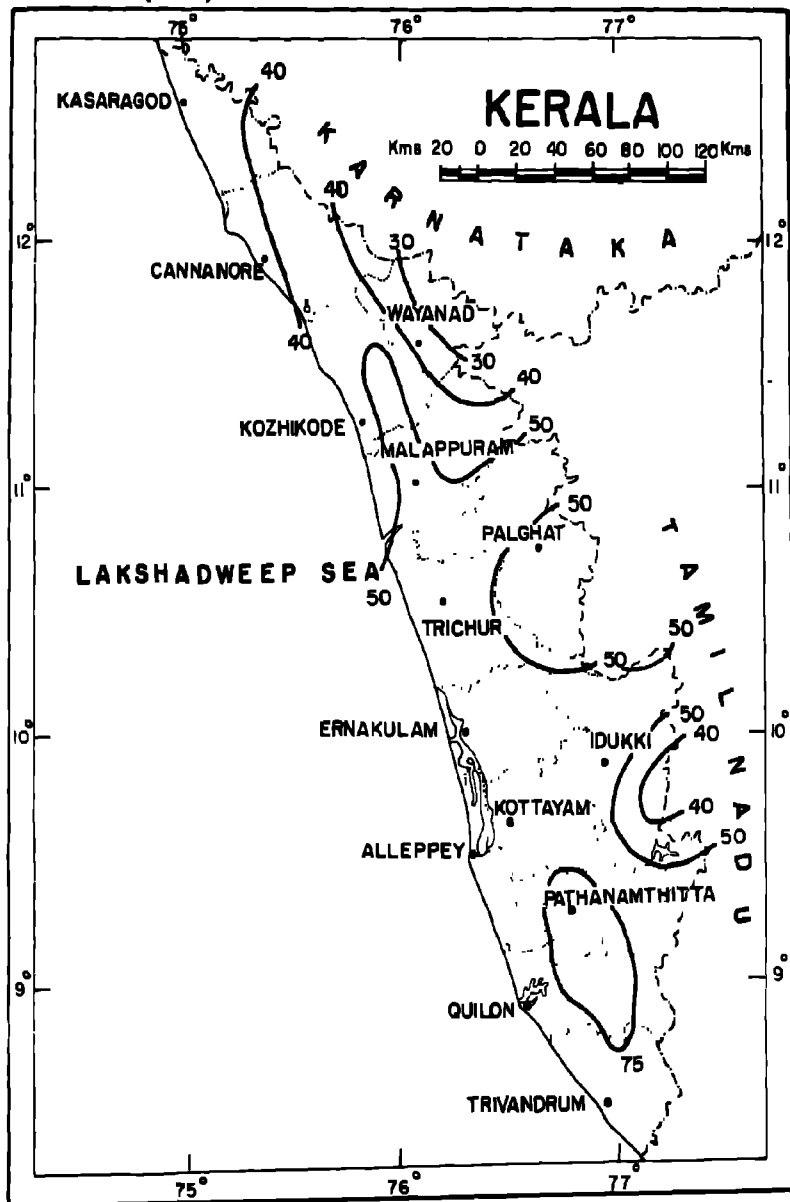



FIG: 6(d)

24. Thirunelli (Manantoddy)	Divisional Forest Officer, Wynad.
25. Konnath	Forest Range Officer
26. Chandanamthode	Forest Range Officer
27. Parappa	Forest Range Officer
28. Chedloth Range	Forester, Kurichal Station
29. Taliparamba	Block Development Officer

Part-Time Raingauge Stations

30. Kollengode	P. W. I. S. R. Railway,	Palghat
31. Thenmalai	* —do—	Quilon
32. Quilon	—do—	Quilon
33. Trichur	—do—	Trichur
34. Alwaye	—do—	Ernakulam
35. Angadipuram	—do—	Malappuram
36. Calicut	—do—	Kozhikode
37. Pantalayini	—do—	Kozhikode
38. Olavakkot	—do—	Palghat
39. Shoranur	—do—	Palghat
40. Cannanore	—do—	Cannanore

* Secretary, Board of Revenue, Kerala State.

APPENDIX I

THE PARASURAMA TRADITION AS INTERPRETED BY GEOLOGISTS

Parasurama's exploit of heaving his battle axe by one effort of his mighty arm to reclaim the region from Gokarnam to Cape Comorin has been accounted for the emergence of Kerala. The tradition is that Parasurama having decided to make amends for his sin of having killed the Kshatriyas of Bharatha twentyone times by gifts of land to Brahmins prayed God Varuna to recede a little and Goddess Earth to raise a bit. Thus the coastal tract of Kerala extending from Gokarna to Cape Comorin was formed by the compliance of Varuna and Earth with Parasurama's prayers. A variation of the legend says that to effect this

compliance, the battle axe was thrown in one stretch to extend from Gokarnam to Cape Comorin.

A geological examination of this tradition will be interesting. The Western Ghats and its spurs consist of metamorphosed igneous rocks, formed by freezing or solidification of the molten material of which the earth consisted in the early ages of its existence. The igneous rocks specifically known as gneisses are well exposed in the cliffs at Varkala in southern Kerala, which the early geological observers termed as the Varkalay Formations—a sedimentary formation ie., a formation laid down in water by natural agencies. This formation is said to be of the Tertiary era. The geological evidence points out that initially the Coast was raised in the eastern border of the backwater tract. Once the coast line became pronounced, a backwater tract was formed with a new coast line further to the west of the ancient shore—line. The reclamation of Kerala may be ascribed to this phenomena and could form the basis of the Parasurama legend. This is further reinforced by one of the version of the *Keralolpathi* which states the land was in a trembling state after being raised from the sea by Parasurama and which was stopped by scattering gold dust and burying a treasure called *Rasippanam*. Geologically there must have been land off the Kerala coast in some former geological age which must have submerged in the sea as a consequence of some violent crust movement.

The same crust movement resulted in the formation of the present Kerala coast. The earth's crust in the neighbourhood of the centre of disturbance will be in a state of unstable equillibrium for some time consequent on a violent seismic disturbance. Due to gradual adjustment of equilibrium there will be tremors which will be felt as earth—quakes ofvarious degrees of intensity. The Parasurama legend takes cognizance of this natural phenomena, which the Kerala coast experienced. The legend thus is the result of an attempt to explain certain natural phenomena experienced by the early inhabitants of Kerala. The period referred to is one when the coast was beginning to attain stability in its slow upheaval and rivers began to form the estuaries which make our present backwater tract. Apparently, the legend was utilised to explain the natural

phenomena experienced by the early inhabitants. Unfortunately by ascribing divine sanction, the socio—political aspect of the legend was exploited to justify the social and political structure then existing.

The Parasurama legend refers to that epoch when the upheaval of the land which now lies to the coast of the backwater tract had terminated and the silting up of the backwater tract had commenced.

APPENDIX – II

The two lists given as Voucher No. I to the Report of the Joint Commission of the Province of Malabar in the years 1792 and 1793 relating to the traditional division of Kerala effected by Cheraman Perumal among the principal persons of his country before laying down Office.

The General partition of Malleam made by Cheruma Perumal and obtained from Major Dow.

Name of the different Granties	Names of their caste	Titles they bore
Collatiry	Samandru Nayr	Colastry
Kurrumbradery	Sammandru Nayr	Keorinenad
Cunmala Condadery	Sanmandru Nayr	Zamorine
Wallarricondery	Ditto	Vallaterra
Nedunganary Paddo	Ditto	Nedunganary
Tirumanchery Mambury	Nambury Brahmin	Tirumanachery
Cacallo Nambury Paddo	Nampidy Brahmin	
Ayroor Courb	Chatrien Brahmin	
Chacarra Courb	—do—	
Cury Courb	—do—	
Maddantumbel Courb	—do—	

Elamgaloor Nambladery	Nambury Brahmin
Punhallo Perumal	Chatrien Brahmin
Onnallo Perumal	Samandu Nayr
Vennatto Perumal	Samandu Nayr
Perubala Nairy	—do—

Appendix – III

The following observation reproduced here from the "Geographical and Statistical Memoir of the Survey of the Travancore and Cochin States" executed under the superintendence of Lieutenants Ward and Conner in 1816 will serve to give the reader of form of government, its character and the petty chieftains and their powers.

"There is reason to believe that at an earlier period when the dominion of Travancore was shared amongst a multitude of petty chiefs, their sway was not marked by the systematic oppression that characterized the rule of a more modern date; the authority of those Princes always limited, often precarious, was with difficulty submitted to by a feudal aristocracy, whose power consisted in the number of their followers and dependants, not revenue, which was derived from personal estates rather thandrawn from the people, their dues being paid in military services or some slight personal contribution. It is not easy to believe, however, that a restless rule of a herd of little chiets, could tend in any high degree to the happiness of the people, but they were least comparatively free from fiscal oppression. The conquest of those principalities united with the discordant mass under one uniform authority, which the latter Princes of Travancore exercised with severity, often maintained by the avowed power of the sword; goaded by exactions their subjects became turbulent, and this proof of their oppression was considered as provoking and justifying a harsher rigour. The Prince absorbed in sensual pleasures was generally held in vassalage by his minister, or abandoned his authority to him, or perhaps evincing a mischievous activity divided or disputed it with him; the Dewan however, in most cases subject only to his capricious control may be considered as having exercised a

supreme military and civil authority, a tyranny that carried down in gradation, was perniciously felt in minute detail. The country, split into three jurisdictions, was ruled by a similar number of Vullia Surva Addigars, but its provincial organization not differing materially from that now obtaining, it is superfluous to trace the divisions into which those portions were separated, or enumerate the various gradation of public servants that administered them; to each was attached accountants who shared largely in their exactions, which their great but mischievous ability well fitted them to direct. On nomination of office, custom familiarized the practice of presenting an offering of money, a courteous bribery[1] repeated annually on certain festivals; they would seem however to have indemnified themselves largely for those concessions, as with small salary and the greatest part of that paid in coap[2] a few years rendered them opulent, but the uncertain tenure by which they held their pillage might have taught them a morality more consonant with justice; reasons for confiscation could never be wanting, and the larger part of their wealth was eventually seized by the Sircar, not scrupulous as to means by which it had been accumulated. Much of the revenue was intercepted in its way to the Treasury, but the rapacity practised in its collection was more serious evil for which however remonstrance or remedy were almost equally hopeless, as enchased, amongst guards and attendants, the chief men could not be approched without a bribe, in every instance an indispensable introduction ot business with the whole chain of secondary authorities who united by a similarity of view were stigmatized by the same want of principle, which spread its depraving influence through the body of the people, placed at their mercy; the arts of fraud being naturally opposed to the power of oppression. this rule, which was fast impressing on the country the usual aspect of modern Hindu desolation, has of

1. Those dutiful offerings with which all titled and privileged persons, as well as public servants, conciliated the good graces of the Chief, bore the denomination of Addigarry. The practice has fallen into disuse, or where continued it is from hope of favour, not obligation.

2. A significant term in very general use, but differently applied : it means supplies generally: is more particularly applied to the article of provision. Thus, one two, &c coap, means subsistence for so many persons, for such a number of days; and in this instance may be translated rations.

late years been completely modified or rather the ancient system stripped of its abuses, has been softened into a rule somewhat similar to that of neighbouring countries, without infringing on its original institutions; the gradual and silent reformation has given society a better form, Government of more permanent security, and reduced a chaos of jarring complicated and mercenary authorities into a compact and efficient regularity. The head of the States enjoys every possible consideration, and as much power and privilege as is necessary to the dignity of the station, or compatible with the happiness of the people. The Dewan[3], the head of the administration, is still invested with an extensive executive authority over all the departments of Government. The country is divided into thirty-two Mundatawaddakuls or districts, having a Tassildar[4] at the head of each; under him are he Sumpurdypully[5] or the principal accountant of the district, two or three Keelcootumpully or assistant accounts; the Moodulbuddycar or cashkeeper, six or eight Seereegoonchootacurra or peons, employed in collections; two or three Vullathuddeecar who act as hircarra; also several Provertycas managing smaller divisions, which have each a Chundrakar or cashkeeper and accountant. The villages of which those divisions are composed have their proper officers exercising a domestic jurisdiction. There still remains a long list of various other officers employed in the collection of the pepper customs[6], in charge of the several Puundysaulays, which the monopolies render necessary, and the large establishment forming the Huzzoor or Dewan's Cutcherry, but their enumeration may be postponed as their duties will be inferred[7]. The native servants are paid in money and enjoy tolerable liberal salaries, at least the higher clases; amongst the lower ranks they may be

3. The office of Dalwye still exists, but it retains only some nominal provilege.

4. This designation has been substituted for Kaureegar.

5. This for Tiruwumpoorchapully.

6. The pepper Monopoly was abolished in December 1860.

7. Amongst the most remarkable are the Dewan Paishkar, Tana Sherisadar, or head of the Police, vullia Maliyailutu Pillay, which may be translated Acountant General, Mailyailutu Pillamars, Sumpurdy Pillamars, Keelcootum Pillamars, Goomastahs, or various ranks of Accountants, Unchull Pillamars, Post Masters; two Moodhulbuddies or Treasurers for Receipts and Disbursements, &c. &c.

considered as almost too small, and the solicitude to obtain office would shew that the stipend is not the only motive. The authorities just enumerated, deprived of any direct power over the persons of the people, act only as collectors of revenue. Justice is administered by a separate judicial establishment, and a Police maintains internal tranquility; a jealous vigilance confines the public servants who are further restrained by acting under security within limits of strict duty; collusion is anticipated by frequent change; aberrations from integrity are corrected by amercement; exclusion from offices or stripes (a paternal admonition sometimes necessary), but this virtue the Nairs when public servants seem to think as impracticable as unprofitable, multiplied check cannot eradicate, a venality that appears natural, because universal, inveterate, almost unconquerable, and the constant succession of new officers while it shews the activity that detects their corruption, betrays the extent of the evil. Complaints are received with readiness; any individual can address them to the Dewan, a privilege liberally exercised, and though not always free from abuse and sometimes degenerating into espionage that cannot but be attended with important advantages; the lower clases and such may be called the whole body of the population, after deducting the Nairs and Brahmins have benefited incalculably by the reformation of a system that exposed them to capricious personal services, and wanton exortion; freed in a great measure from those oppressions, they promise to rise above those degrading distinctions that have hitherto stigmatized them, their industry must revive with a certainty of enjoyment, nor can they fail desiring the continuance of a domination to which they so much owe it. There is but one authority recognised and obeyed throughout the country; the few petty chiefs in it exercise but little power within their own limits; the descendants of the feudal aristocracy known under the names of Maudumbymar, Prubbukamar, Kurtaos, &c., are now scarcely distinguished from the body of the people amongst whom they have little influence—a change of sentiment that would augur for the continuance of repose; circumstances have completely established British influence over this fine principality, and the exercise of it must essentially promote its prosperity in which we must feel a sort of compatriotic interest. The feelings that stimulated to the

commision of hostilities at no very distant date seem wholly to have subsided, and the present tranquility which bears the appearance of permanency affords a striking and favourble contrast to the restless turbulence of those times; if conclusion may be drawn from personal observation, a favourable estimation must be formed of the general sentiments entertained towards the British, and the ascendancy of its power always exercised with considerable humanity and forbearance would seem to inspire a prevalent confidence and satisfaction that must be matured by the duration of its influence, the opinion perhaps may admit of some qualifications, as allowance must be made for the dissembling profession that characterize the higher classes, who unaccustomed to the restraints of principle or justice, may not yet be reconciled to an authority that enforces them. The rising consideration too of the lower classes, may wound their pride, as diminshing their dignity by limiting their influence: but dissatisfaction arising from such a source can scarcely be a subject of regret, and it effects would be more than counteracted by the results springing from its cause.

The claims of lineal inheritance being the same with the Nairs, the succession to the musnud is in the female line. The ladies of the Royal Family are denominated Tumbrattys (Queens); the eldest is styled Autungal Moopu and has a Jaghier in Sherienkeel. Sisters or aunts of the Prince select husbands from the Kshetry caste, and generally choose them form the Killymanoor family.

YEDDAWUGGAYS OR PETTY STATES—There are still a few small States or Yeddawuggays allowed to exist, but the power of their chiefs is in most cases reduced to a nominal authority; the decision of all criminal and judicial questions belong solely to the Sirkar. To the south, the tract of Autungal constitutes the state of the eldest female of the reigning family. In its vicinity is Killymanoor, a small territory belonging to the Rajah of that name, commonly called Coil Pundala, who appears to hold it in consideration of his being connected with the family of the Ranee. The Pundalum State embraces a wide but woody extent within its limits, till later times its Prince enjoyed a comparative degree of independence; he however is now

degraded to the condition of pensioner, nor does his trifling stipend allow him more than a bare subsistence. In consequence of some debts due to the Sircar, it has asumed (since 1820) the entire administration of the country known as Pundalum. The Vunjeepolay Yeddawuggay situated in the neighbourhood of Changanacherry is the property of a Potie of high rank, whose possessions however yield him but a trifling revenue; he holds them in right of some spiritual dignity; but the Yeddapully Rajah must be more immediately considerd th family priest of the Princes of Travancore. The territory of this chief is of all those small states the most populous and productive; it has been seen that it is composed of several detached portions, Yeddapully being the residence of its ruler, a Nambeadry, who has a wide spiritual, but limited temporal control. Portions of the mountainous tracts are nominally held by the pagodas of Narthoad, Tricarur, and Chenganad; much of them are still sahred amongst petty chiefs, some of the Kshetry tribe, others of inferior origin. The mountaineers who possess the southern parts of the Cardamom Hills acknowledge the sovereignty of the Pundalum Rajah. The Mannamars consider themselves the subjects of the Travancore Government; the chief of this clan as an acknowledgement of his fealty pays a trifling sum annually to the Thoduwully pagoda: he some years since received a sword from the Rajah of Travancore, an investiture that implied an admission of his authority in return for his allegiance; but of all those mountainous domains, that of Pooniatu is next to Pundalum the largest; its chief, termed pooniatu Perumal, holds a doubtful and unprofitable sway over an immense hilly tract, peopled by a few migratory tribes. A more minute account of those chiefs and the extent and nature of their territories will be found on reference. There are within Travancore two confined tracts belonging to the British. Anjengo, one of its earliest settlements, and Tanguncherry, once a Dutch posession; the former under the management of the Resident, the latter appertains to the Malabar Collectorate. Munnaputh has already been described as a small tract belonging to Travancore, at present held in rent by an English gentleman.

DISTRICT AND VILLAGES IN THE TRAVANCORE STATE IN 1820*

Names of the Districts			Villages	Village Officers
(1)			(2)	(3)
Toovauly	District	S	30	..
Toovauly		N	21	..
Agusteshuvaren	Do.	S	24	..
Agusteshuvaren		N	35	..
Cakkolum	Do.	S	98	172
Cakkolum		N	103	176
· Vellavencode	Mundaputtum Wauda-		91	..
Neyattencurray	cull or District		104	478
Trivanderum	District	S	31	92
Trivanderum		N	33	124
Neddoovencaud	Mundaputtum		52	174

Sharinkeel	Waudacull or		70	270
Kolum or Quilon	District		156	198
Kotarakurray	District	S	176	102
Kotarakuray		N	70	83
Shenkotta, above the Ghaut	District	..	27	..
Kunatoor		..	121	120
Mauvillykurray	Do.	S	93	149
Mauvillykurray		N	108	98
Teruwulla			130	106
Karnagapully			122	212
Kartigapully			71	14
Umbellapolay			72	120
Sharetullay			37	..
Chunganacherry	Mundaputtum		62	56
Kotium	Waudacull or		84	62
Meenachel	District		64	50
Thodhuwully			67	68
Yathumannur			49	42
Vyekkum			60	43
Peerawum			96	58

Muauttupully	140	100
Perrumbaulur or Kunnutunaad	109	71
Aullungaad	103	86
Purraur	72	56
Yeddawagga or Petty States		
Autingull	17	78
Pundalum	52	79
Yeddapully	47	23
Pooneatu	8	6
Wunjepolay	3	16
Total:	**2,908**	**3,582**

* Memoir of the Travancore Survey. P. 46.

DISTRICTS AND VILLAGES IN THE COCHIN STATE IN 1820*

Names of the Districts		*Villages*	*Village Officers*
(1)		*(2)*	*(3)*
Cochee or Cochin		50	301
Trichoowapayroor		95	35
Mukundapuram		52	19
Thullapilly	Covilugghuttum Waudakul or District.	114	306
Kuuneeanur		102	281
Yainamakul		70	185
Chayalayekurray		48	37
Chittoor		45	40
Codachayree		61	71
Kodungaloor		6	57
	Total:	**616**	**1,332**

* Memoir of the Travancore Survey, P. 49.

APPENDIX — IV

Given here is a summary of the 'Reports of A Joint Commission Bengal and Bombay appointed to inspect into the State and condition of the Province of Malabar in the years 1792 and 1793" which throws light on the State of Malabar when it was ceded to the English East India Company with the signing of the treaty of Seringapatam with Tipu Sultan on March 18, 1792 A. D. These reports are among the Foreign Miscellaneous Series preserved in the National Archives. Alongwith the "Procedure Volumes" and a Supplementary Report of 1792—94 the reports among other things give the researchers of Kerala History an objective assessment of the prevailing situation in the 1790's in Malabar. The study of these reports is to be supplemented with the "Minutes of Sir John Shore on the Report of the joint Commissioner of Malabar". The report is addressed to "The Marquis Cornwallies, K. C.: Governor General in council, at Fort William". The report is divided into three parts "to render our relation ofcircumstances more intelligible as well as useful for future occasional reference. It is our intention—First, to take some notice, by way of introduction to the subject at large, of the ancient state of Malabar according to the Natives' own ideas and received notions of its history, as well as the most material of its subsequent revolutions (as far as may be necessary to thorw light on our proposed ultimate arrangements) upto the period of the late sub-division on of Tippoo Sultan's Government—Secondary, to insert a comprehensive summary or recapitulation of the principal circumstances in the progress made by the Commissioners from Bombay, previous to their being joined by those from Bengal, and —Thirdly, to show what have since been the joint proceedings of those from both the Presidencies.

REPORTS OF THE JOINT COMMISSION — BENGAL AND BOMBAY IN THE YEARS 1792 & 1793

Para 78. Jummabundy of the countries which are ceded to the Honorable English East India Company by Tippoo Sultaun according to the following detail, dated the 19th March 1792, corresponding to the 22nd Ryil, 1206 Hegiree:

Talooks oppertaining to Calicut

63 Talooks

		Country Hoons or Pagodas	Fanams	Annas	Country Hoons or Pagodas	Fanams	Annas
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1st	Talook Cusba, Calicut, 3 Talooks, Cusba (chief or head district)						
	Wypoor or Beypoor	38,236	8	0			
	Ramnayr or Ramnaad	8,071	7	12			
	Purrupayr or Parrupnaad	8,863	3	0			
					55,171	8	12
2nd	Talook Goorymnayr or Coorumnayr or Coorumnaad, 7 Talooks						
	Cusba	12,725	0	14			

	Calicut	12,957	3	5			
	Panayr or Payanaad	17,630	5	14			
	Purmulla or Pyoormullah	17,015	9	0			
	Kul kumra, or Curcumbra	12,513	8	3			
	Wurkumra or Wurcumbra	10,535	7	2			
	Poolwaye or Poorwye including Tambercherry	11,564	8	8			
					94,943	2	14
3rd	Talook Peludnayr or Vettulnad. 10 Talooks						
	Cusba	14,736	1	14½			
	Mylatoor, an original part of Vellatre	12,192	4	15			
	Angarypoor or Vellatre	13,615	4	5			
	Kulkumdela, an original part of the Cusba of Vettulnad	9,641	3	4½			
					50,185	4	7

(1)	(2)	Country Hoons or Pagodas (3)	Fanams (4)	Annas (5)	Country Hoons or Pagodas (6)	Fanams (7)	Annas (8)
	Shurnayr or Sheenaar	10.982	9	11			
	Poontanny or Poonany	14.073	7	5			
	Kootay or Cootay, an original part of the Cusba of Vettutnaad	8.159	4	5			
	Wunnayrgar or Wunarcar	6.386	2	14			
	Kapul or Capool	5.480	1	4			
	Wikittycote or Vencutticotta	16.701	8	0			
					1.11.989	7	14
4th	Talook Wuruntnaye or Wurternar or Ernaar, 4 Talooks						
	Cusba or Munjery	13.515	0	4½			
	Mulpoor or Mullapoorum	6.608	7	6			
	Moreyoor or Murgoor	11.117	3	2			
	Wullularycote or Aricode	10.130	0	0			
				41.371	41.371	0	12½

		Country Hoons or Pagodas	Fanams	Annas	Country Hoons or Pagodas	Fanams	Annas
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
5th	Talooks Shaadgur or Sawkar or Chowghaut. 11 Talooks						
	Cusba	12.954	0	8¼			
	Wunnerykeelkyparah or Wunar Kulkipaar	12.466	2	9			
	Kulkynayr or Culkinaad	12.445	6	6			
	Kolecullynayr or Coolcoolinaad	10.549	9	2			
	Korungeloor or Corungiloor in the Island of Chetwa	7.117	9	14½			
	Sutwye or Setwye Munnapooram, or the rest of the Island or Chetwa, exclusive of Corungaloor	7.567	6	14			
					63.101	5	5¾
	Turunganayr or Neringanad	13.584	2	6			
	Kadnallekadush or Pudnalickdesh an original part of Neringanaad	13.916	7	0			

(1)	(2)	(3) Country Hoons or Pagodas	(4) Fanams	(5) Annas	(6) Country Hoons or Pagodas	(7) Fanams	(8) Annas
	Kurrumpulla or Currumpoora	6,700	0	0			
	Turtalla, an original part of Neringanaad	10,394	5	13			
	Kowalparah	8,328	8	9½			
					1,16,025	9	4½
6th	Talook Ecravynayr or 2 talooks						
	Cusba	11,430	3	4½			
	Kullaye or Col ingolte	4,470	4	3½			
					15,900	7	7½
7th	Talook Cherukul or Chericul 5 Talooks						
	Cusba	21,173	0	6½			
	Puttoon	19,499	3	2½			
	Randaterra	13,137	8	1			

	Gowaye	12.176	0	10½			
	Murraye	(1)24.486	3	6			
					80.472	5	10¾
8th	Talook Coteaugria or Cottatu. or Cottote. 3 Talooks						
	Cusba	14.518	7	2½			
	Putchy	12.654	0	5			
	Coolyary	12.828	5	3			
					40.001	2	10½
9th	Talook Kurruntanayr or Curtinaad 3 talooks						
	Cusba Kooteepoor or Cooteepoor	18.777	5	9½			
	Yergurrah	13.192	3	15½			
	Kawul	18.139	0	5½			
					50.108	9	14¾
10th	Talook Cartanoor or Talook of Cannanore						
	1 Talook	..	..	..	30.000	0	0
11th	Talook Cochy or Cochin 14 Talooks						

Toorshmeron	10,000	0	0			
Mukluntpoor	10,000	0	0			
Colicherry	7,000	0	0			
Alnamgull	6,000	0	0			
Tupooly	7,000	0	0			
Mollorkurra	5,000	0	0			
Chaalkaarra	5,000	0	0			
Alloornumary	10,000	0	0			
Chilloor Tulmungul	20,000	0	0			
Allungaar	4,000	0	0			
Paroor	4,000	0	0			
Koonuthayr	4,000	0	0			
Shadmunggul	4,000	0	0			
Colicherry	4,000	0	00			
				1,00,000	0	0

		Country Hoons or Pagodas	Fanams	Annas	Country Hoons or Pagodas	Fanams	Annas
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
12th	Profits on black pepper, mint, and duties on timber & c. Farm of the timber duties	30,000	0	0			
	Duties on Tobacco	2,800	0	0			
	Mint	30,000	0	0			
	Black Pepper, Cocanut &c.	50,000	0	0			
		1,12,800	0	0			
	Total of the former Malabar District	..	..	..	8,48,765	5	4½
	Add for the Koorg or Coorga Talook Paulghautcherry	8,000	0	0			
		88,000	0	0			
					96,000	0	0

	Total of Tippoo's valuation of the Cessions of the districts placed under Bombay; in Country Hoons or Pagodas	..	..		..9,44,765	5	4½
79th	The preceding arrangements of the districts with their valuation as contained in Tippoo Sultan's schedule, being divided into those Northern and Southern divisions of Malabar inserted in the 34th & 39th paragraphs of this report will stand as follows:						
	First, of the Northern Division:						
	1st Cartinaad	..	..	..	50,108	9	14¼
	2nd Cannanore	..	..	..	30,000	0	0
	3rd Chericul, i.e., exclusive of Randaterra	67,334	7	9¼			
	Add Randaterra (afterwards annexed to Chericul by Tippoo).	13,137	8	1	80,472	5	10¼
					80,472	5	10¼

Arrangements of this Jumma according to the local Northern and Southern and other divisions of the country

		Country Hoons or Pagodas	Fanams	Annas	Country Hoons or Pagodas	Fanams	Annas
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
4th	Cotiote (after the period of the separation of Wynad)	..	..	..	40,001	2	10¼
5th	Irvornaad	..	..	..	11,430	3	4¼
6th	Coringotte	..	..	..	4,470	4	3¼
	Total of Tippoo's Jummabundy of the Northern Ceded districts of Malabar	..	..	..	2,16,483	5	11¾
	Secondly, of the Southern districts:						
1st	Tookrie, or division of Calicut	55,171	8	12			
2nd	Tookrie, or division of Coorimnaad	94,943	2	14			

3rd	Tookrie, or division of Vettutnaad	1,11,969	7	14			
4th	Tookrie, or division of Wurter-naar or Ernaad	41,371	0	12¼			
5th	Tookrie, or division of Sankar	1,16,025	9	4¼	4,19,481	9	8½
	Total of Land Revenue and Customs of the Northern and Southern divisions of Malabar according to Tippoo's Jumma-bundy	..	..	..	6,35,965	5	4¼
	Thirdly of sundries in the said Northern and Southern divisions						
	1st Timber duties	30,000	0	0			
	2nd Tobacco —do—	2,800	0	0			
	3rd Mint —do—	30,000	0	0			
	4th Black pepper, Coconuts &c.	50,000	0	0	1,12,800	0	0

Total of Tippoo's Jummabundy for the Northern and Southern Malabar districts ceded to the Company exclusive of Paulghautcherry, Koorg and Cochin	..	..	..	7,48,765	5	4¼
Add for Paulghautcherry	88,000	0	0			
Add for tributary district of the Koorg or Coorga	8,000	0	0			
				96,000	0	0
				8,44,767	5	4¼
Add for the tributary district of Cochin	..	..	..	1,00,000	0	0
Total of Tippoo's valuation of these cessions	..	..	..	9,44,765	5	4¼

Appendix IV – A

The Report of the Joint Commission of Bengal and Bombay appointed to inspect into the state condition of the Province of Malabar in the years 1792 and 1793 in their report to Lord Cornwallis, Governor General enumerate the districts in the northern and southern divisions of the ceded countries in Malabar thus:* Para 16.......two grand divisions, the northern and southern separated by the Toorshairoo or Cotta river; that to the northward comprehending the ancient Colastrian range or kingdom, now dismembered and partitioned out into the several principalities or districts of – 1st.

Northern division comprehends Chericul, Cottatu with Wynaad. Cartinaad

Chericul or Coticote, annexed to which was, or is, Wynaad above the ghauts (the former peculiarliy noted for the production of pepper, and the latter for cardamoms); 3rdly, the district of Cartinaad (the woods in which contain abundance of neglect cassia or wild cinnamon); and 4thly, the petty township and

Cannanore with Laccadives

contiguous districts of Cannanore (held by a Mopilla family, possessing also the greater part of the Laccadivia island, and which is much respected by all the others of the same tribe throughout Malabar); and 5thly, 6thly, the small talooks of Irvenaad, Corangotto and Randatters, which last mentioned place had become subordinate,

Irvenaad with Corengotte and Randattera

to the settlement of Tellicherry, in the manner that will be hereafter pointed out.

17. The districts to the south of the Toorshairoo river contain – 1st, Coorimnaad a distinct and independent Rajaship; and 2ndly, those districts that formed the dominions of the

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* Report of the Joint Commission of the Province of Malabar : Paras 16 and 17; Fort St. George Gazette Press 1862 Madras.

Coorimnaad and the Samoory's and other districts in the Southern Division, viz. Pynaad, Warcumbra, Curcumbra, Ernaad, Shernaad, Venketty Cotta, Malapuram, Capool, Weenarcar, Champera, Neringanaad and Poonany, together with Pyoormulla and Poorwye, Beypoor, Perephaar Bettutnaad, Velatre and Paulghaut, &c.	of the Samoory or Zamorin, such as Pynaar with Warcumbra and Curcumbra to the north and east of Calicut; and to the southward of

that city and district, the countries of Ernaad, Shernaad, Venkelty Cotta, Malapuram, Capool, Weenarcar, Champera, Neringanaad and Poonany, besides which the Samoory claimed to be, with a more or less influence, the paramount sovereign over the Nayrships of Pyoormulla and Poorwye to the north and east of Calicut, and to the southward, of the Rajaships of Beypoor, Perepnaar, Bettut or Vettutnaar, and Tellapellie, called also Soukar and Chowghaut, including the Nayrship of Coulpara; and he had also possessed himself of the more full and immediate sovereignty over the three Nayrship of Colamgoora, Codovours or Koorwye and Mungary, originally a part of the Paulghaut country; so that, exclusive of the residue of this last mentioned district, and of the three lesser Nayrships of Congad, Manoor, and Yerterra and of the district of Coorimnaad and of that of Velatra or Velnatera (in the southern division of Malabar), the family of the Zamorin had, by a continued service of warfare and contest thus reduced (before the period of their own expulsion by Hyder Ali Khan), to a greater or less degree of subordination and dread of their power, all the Rajahs, Chiefs, and landholders of the countries lying between the Toorshairoo river, (which is above stated to have been the boundary of the ancient Colastrian kingdom) and that of Cochin.

The places mentioned in the report may probably be identified with the modern place-names given below:

Bettutnaad	Vettathunad, the northern portion of Ponnani
Beypoor	Beypore branch of the Parappanad family

Cartenad	Kadattanad
Chericul	Chirakkal
Chumpoora	Chamberra outlying Mahe
Codovours	Koduvayur
Colamgoora	Kollengode
Clastrian	Colattiri
Congad	Kongad
Coticote	The inflected form of Kottayam the taluk in which Tellicherry is situated
Cottatu	Kottayam
Corangotto	Kurangottu in Iruvazhinad in Kottayam taluk
Coorimnaad	Kurubranad
Curcumbra	Chembra
Ernaad	Eranad
Irvenaad	Iruvazhinad
Laccadivia	Laksha Dwipu or Laccadives
Malapuram	Malappuram
Manoor	Mannur
Mungary	Mankary
Neringanaad	Nedunganad leased to the Zamorin in A. D. 1792
Paulghat	Palghat
Perepnaar	Parappanad
Poonany	Ponnani
Poorwye	Paraye, Pozhavayi formerly a district east of Calicut
Pyoormulla	Payurmulla
Pynaad	Payyanad
Randaterra	Near Dharmapatham
Shernad	Cheranad—A portion of the present taluk of Ernad
Soukar	Chavakkad
Tellapelley	Thalappally
Toorahairoo	Shiriya river
Velatre	Vellatre viz. Walluwanad
Venkettycotta	Venkitakotta
Warcumbra	Vadakaporam
Yetterra	Edathara

Appendix IV – B

Extract of a letter from Robert Raylor Esquire, Chief of Tellicherry to the Commissioner dated 8th March, 1793.

Divisions of the maleam

Name of the Rajahs	*Name of the Country*
Penall Adiguel	Travancore
Colate Adguel	Cherical
Cunalaconatery	Tamorine
Valuconaterry	Vattatara near Cabul
Erratery	Erratary Ditto
Porlatery	Formerly Polengal near Cabul the present Rajah of Cartenad
Currumbenatery	Currumheral
Caungolon	Caungolon between Cochin & Travancore
Maddamporapody	King of Cochin
Maddamporponat	Porponal South of Calicut
Aitur	Alangaut near Travancore Lines
Cheracarra	Paroor
Panadalatu Rajah	Pandalatu now included in Travancore
Vettet Rajah	Vettet near Perpenat
Vengenatt Nambydy	Colomcodd Cadwanjur Palagantchie

N. B. **Although the above table of Partition has been delivered into the Commission as an authentic Statement, Yet in respect to a (torn) that hath passed do many centuries it cannot be supposed that the Commissioner can mean otherwise to introduce it than as probably declination of what tradition hath handed down and as being (torn) well enough adopted to give a general idea of the fact without (torn) being accurate in the particulars.**

(A true copy) and Extract.

Sd/-
Peter. Pare Travers,
Acting Secretary.

Appendix IV – C

The area, number of towns and villages in the erstwhile Malabar District in 1921 are given below:

Locality	Area in square miles	Number of Towns	Villages
CALICUT DIVISION			
Calicut	379	1	179
Kurumbranad	505	1	337
COCHIN DIVISION			
Cochin	2	1	1
MALAPPURAM DIVISION			
Ernad	966	..	221
Walluvanad	880	..	317
PALGHAT DIVISION			
Palghat	613	1	136
Ponnani	416	2	457
TELLICHERRY DIVISION			
Chirakkal	682	1	269
Kottayam	481	1	223
Wynaad	821	..	58
LACCADIVE ISLANDS	7	..	5
DISTRICT TOTAL:	5,792	8	2,203

The two taluks of Anjengo and Tangasseri had been transferred to Tinnevelly District with effect from July 1, 1927.

Appendix – V

1. Kerala State was formed with effect from 1st November 1956 as per the States Reorganisation Act, 1956 (Central Act 37 of 1956). Sections 4 and 5 of the States Re-organisation Act, 1956 fixing the territories are extracted below:—

4. As from the appointed day, there shall be added to the State of Madras the territories comprised in the Agastheeswaram, Thovala, Kalkulam and Vilavancode taluks of Trivandrum district and the Shencottah taluk of Quilon district; and thereupon—

(a) the said territories shall cease to form part of the existing States of Travancore-Cochin;

(b) the territories comprised in the Agastheeswaram, Thovala, Kalkulam and Vilavancode taluks shall form a separate district to be known as Kanya Kumari district in the State of Madras; and

(c) the territories comprised in the Shencottah taluk shall be included in, and become part of, Tirunelveli district in the State of Madras.

5. As from the appointed day, there shall be formed a new Part A State to be known as the State of Kerala comprising the following territories, namely:—

(a) the territories of the existing State of Travancore-Cochin, excluding, the territories transferred to the State of Madras by Section 4; and

(b) the territories comprised in —

(i) Malabar district, excluding the islands of Laccadive and Minicoy and

(ii) Kasaragod taluk of South Kanara district; and there upon the said territories shall cease to form part of the States of Travancore-Cochin and Madras, respectively.

The territories specified in clause (b) of sub-section (1) shall form a separate district to be known as Malabar district in the State of Kerala.

Appendix – VI

Changes in jurisdiction since November 1, 1956 to March 1, 1981.
District—level changes

(i) Idukki district was formed on 26th January, 1972

(i) Idukki district was formed on 26th January, 1972 consisting of Devicolam, Udumbanchola and Peermade taluks of the erstwhile Kottayam district as Thodupuzha taluk (excluding Kalloorkkad village and portion of Manjalloor village included in Manjalloor and Kalloorkkad panchayats) of Ernakulam district.

(ii) Silent Valley reserve forest area in Karuvarakundu village of Ernad taluk of Malappuram district was transferred to Mannarghat taluk of Palghat district (Notification dated 17th August 1976).

(iii) North Wynad taluk of Cannanore district was transferred to Kozhikode district with effect from 1st January, 1979.

(iv) Wynad district was formed on 1st November 1980 comprising of the North Wynad and South Wynad taluks of Kozhikode district.

Taluk—level changes

(i) Consequent on the formation of Idukki district, a new taluk by name Kothamangalam was carved out of Muvattupuzha taluk of Ernakulam district on 26th January, 1972 comprising of nine villages (Kuttamangalam, Pindimana, Kottappady, Eramalloor, Keerampara, Kothamangalam, Varappetty, Kadavoor and Pothanicaud villages).

(ii) Kalloorkkad village and portion of Manjalloor village included in Kalloorkkad and Manjalloor panchayats of Thodupuzha taluk were added to Muvattupuzha taluk.

(iii) Kottumala area of Mattathur amsom in Othukkungal village of Tirur taluk of Malappuram district was added to Oorakam village of Ernad taluk (Notification dated 16th July, 1975).

(iv) Five villages Edathiruthy, Kaipamangalam, Perinjanam, Pappinivattam and Sreenarayanapuram of Chavakkad taluk of Trichur district were transferred to Kodungalloor taluk of the same district (Notification dated 5th December, 1975).

(v) Silent Valley reserve forest area in Karuvarakundu village of Ernad taluk of Malappuram district was transferred to Mannarghat taluk of Palghat district (Notification dated 17th August, 1976).

(vi) Elikkulam village of Kottayam taluk of Kottayam district was transferred to Kanjirappally taluk of the same district (Notification dated 18th September 1979).

(vii) Consequent on the formation of Wynad district, the following changes were made.

(a) The North Wynad taluk was renamed as Mananthavaddy taluk.

(b) South Wynad taluk was bifurcated into Sultan's Battery and Vythiri taluks—Sultan's Battery taluk consisting of Poothadi, Pulpalli, Kidanganad, Noolpuzha, Sultan's Battery, Purakkadi, Ambalavayal and Nenmeni villages and Vythiri taluk consisting of Padinjarethara, Kuppadithara, Kottathara, Kaniambetta, Muttil, Kalpetta, Vengappally, Thariyode, Achooranam Kunnathidavaka, Kottappadi and Muppainad Villages.

DETAILS OF CHANGE

CANNANORE DISTRICT

Taluk	
Hosdurg	Panatady village bifurcated into Kallar and Pananthady villages.

Taliparamba	(i) Eruvassy village bifurcated into Payyavoor and Eruvassy villages
	(ii) Naduvil village bifurcated into Vellad and Naduvil villages.
	(iii) Thadikkadaw village bifurcated into Thimeri and Alakode villages

WYNAD DISTRICT

Mananthavady	Thirunelli village bifurcated into Thirunelli and Trissaleri villages
Sultan's Battery	(i) Pulapalli village bifurcated into Pulapalli and Padichira villages
	(ii) Poothadi village bifurcated into Poothadi and Irulam villages

MALAPPURAM DISTRICT

Ernad	(i) Kalikavu village bifurcated into Kalikavu and Chokkad villages
	(ii) Amarambalam village bifurcated into Amarambalam and Karulali villages
	(iii) Nilambur village bifurcated into Nilambur and Akampadam villages
	(iv) Edakkara village bifurcated into Chungathara and Karumbilangode villages

	(v) Chungatharavillage bifurcated into Chungathara and Karumbilangode villages
	(vi) Karuvarakundu village bifurcated into Karuvarakundu and Kerala Estate villages
ERNAKULAM DISTRICT	
Alwaye	Alwaye village bifurcated into Alwaye East and West villages
IDUKKI DISTRICT	
Devicolam	Mannankandam village bifurcated into Mannankandam and Kuttampuzha villages
Udumbanchola	(i) Ayyappancoil village bifurcated into Ayyappancoil and Kattappana villages
	(ii) Pampadumpara village bifurcated into Pampadumpara and Karunapuram villages
	(iii) Kalkoonthal village bifurcated into Kalkoonthal and Tankamany villages
	(iv) Koonathadi village bifurcated into Koonathadi and Vathikudi villages
Peermade	(i) Peruvanthanam village bifurcated into Peruvanthanam and Kokkayar villages
	(ii) Pasuppara village bifurcated into Upputhara and Vaghamon villages

(iii) Peermade village bifurcated into Peermade and Manchumala villages

(iv) Periyar village bifurcated into Periyar and Kumili villages

KOTTAYAM DISTRICT

Meenachil	Poonjar Thekkakara village bifurcated into Thekkekara and Kootickal villages
Kanjirappally	Erumeli village bifurcated into Erumely North and Erumely South villages

ALLEPPEY DISTRICT

Ambalapuzha	Alleppey village bifurcated into Alleppey West and Alleppey East villages
Chengannur	Aranmula village bifurcated into Aranmula and Kindangannur villages

QUILON DISTRICT

Karunagappally	Thekkumbhagom village bifurcated into Thekkumbhagom and Neendakara villages
Kottarakkara	Chadayamangalam village bifurcated into Chadayamangalam and Nilamel villages
Quilon	Quilon village bifurcated into Quilon and Sakthikulangara villages
Pathanamthitta	Vadasserikkara village bifurcated into Vadasserikkara and Chittar—Seethanthode villages

Appendix – VII

Districts, Taluks, Headquarters and Villages in Kerala

TRIVANDRUM

Taluk (1)	headquarters (2)	Villages (3)
Chirayinkil	Attingal	1. Kilimanoor
		2. Pazhayakunnummel
		3. Kulimath
		4. Koduvazhannur
		5. Nagaroor
		6. Karavaram
		7. Madavoor
		8. Pallickal
		9. Vellalloor
		10. Navaikulam
		11. Alamcode
		12. Edakode
		13. Elamba Mudakkal
		14. Azhoor
		16. Sarkara—Chirayinkil
		15. Kizhuvilam—Koonthalloor
		17. Kadakkavur
		18. Ottoor
		19. Manampoor
		20. Vettoor—Cherunniyoor
		21. Varkala
		22. Edava
		23. Ayiroor
		24. Chemmaruthi
		25. Attingal Avanavancherry
		26. Keezhattingal.
Nedu-mangad	Nedu-mangad	1. Mannoorkara
		2. Aryanad
		3. Vithura

(1)	(2)	(3)
		4. Tholikkodu
		5. Uzhamalakkal
		6. Porumkulam
		7. Veeranakavu
		8. Vellanad
		9. Nedumangad
		10. Anadu
		11. Panavur
		12. Manikkal
		13. Vembayam
		14. Karakulam
		15. Vamanapuram
		16. Kallara
		17. Nellanad
		18. Palode
		19. Peringammala
		20. Pullampara
Neyyattin-kara	Neyyattin-kara	1. Kulathoor
		2. Chenkal
		3. Parassala
		4. Kollayil
		5. Kunnathurkal
		6. Vellarada
		7. Ottasekharamangalam
		8. Kallikkadu
		9. Perumkadavila
		10. Kezharur
		11. Neyyattinkara
		12. Athiyannur
		13. Thirupuram
		14. Karumkulam
		15. Kottukal
		16. Pallichal
		17. Vilappil
		18. Marukil
		19. Maranalloor
		20. Kulathummel

(1)	(2)	(3)
Trivandrum	Trivandrum	1. Nemom
		2. Thiruvallam
		3. Aramada
		4. Anchamada
		5. Cheruvakkal
		6. Melthonnakkal
		7. Velloor
		8. Andoorkonam
		9. Ayiroopppara
		10. Uliyazhathura
		11. Kadinamkulam
		12. Kezhthonnakkal
		13. Attipra
		14. Kazhakkuttom—Menakulam
		15. Pangappara
		16. Vanchiyur
		17. Iranimuttom
		18. Kadakampalli
		19. Palkulangara
		20. Muttathara
		21. Randamada
		22. Chettivilakom
		23. Pallippuram
		24. Madathuvilakom
		25. Ulloor
		26. Chengazhasseri
TOTAL 4		92

QUILON

(1)	(2)	(3)
Quilon	Quilon	1. Kalluvathukkal
		2. Meenad
		3. Bhoothakulam
		4. Adichanelloor
		5. Paravoor
		6. Mayyanad

(1)	(2)	(3)
		7. Iravipuram
		8. Quilon
		9. Vadakkevila
		10. Kilikolloor
		11. Thrikkadavur
		12. Thrikkaruva
		13. Thrikkovilvattom
		14. Nedumpana
		15. Mulavana
		16. Perinad
		17. Monroe Island
		18. Kottamkara
		19. East Kallada
		20. Sakthikulangara
Kottarak-kara	Kottarak-kara	1. Ezhukone
		2. Kottarakkara
		3. Pavithreswaram
		4. Neuvathur
		5. Kulakkada
		6. Mylom
		7. Thrippalazhikom
		8. Veliyam
		9. Pooyappally
		10. Omannoor
		11. Vettikkavala
		12. Melila
		13. Chithra
		14. Ittiva
		15. Kadakkal
		16. Chadayamangalam
		17. Velinalloor
		18. Elanad
		19. Nilamel
Karunagap-pally	Karunagap-pally	1. Thekkumbhagom
		2. Chavara

(1)	(2)	(3)
		3. Panmana
		4. Karunagappally
		5. Thodiyoor
		6. Thodiyoor
		6. Thazhava
		7. Kulasekharapuram
		8. Perinad
		9. Krishnapuram
		10. Neendakara
Kunnathur	Sastham-cottah	1. Kunnathur
		2. Poruvazhy
		3. Pallikkal
		4. West Kallada
		5. Sasthamcottah
		6. Sooranad North
		7. Sooranad South
		8. Thevalakkara
		9. Mynagappally
Pathana-puram	Pathana-puram	1. Pattazhi
		2. Thalavoor
		3. Vilakkudy
		4. Pidavoor
		5. Pathanapuram
		6. Punalur
		7. Karavaloor
		8. Anchal
		9. Edamulakkal
		10. Arakkal
		11. Piravanthur
		12. Edamon
		13. Ariencavu
		14. Kulathupuzha
		15. Eroor
		16. Alayamon
TOTAL: 5		74

ALLEPPEY

(1)	(2)	(3)
Alleppey	Ambala-puzha	1. Mararikkulam
		2. Aryad North
		3. Alleppey *(Portion)*
		4. Punnapra
		5. Ambalapuzha
		6. Purakkad
Shertallai	Shertallai	1. Mararikkulam North
		2. Kanjikuzhi
		3. Thanneermukkom North
		4. Thenneermukkom South
		5. Shertallai South
		6. Shertallai North
		7. Kokkothamangalam
		8. Arur
		9. Mattathilbhagam
		10. Panavally
		11. Thycattussery
		12. Thuravoor North
		13. Thuravoor South
		14. Vayalar West
		15. Vayalar East
		16. Pallippuram
Kuttanad	Kuttanad	1. Thakazhi
		2. Thalavadi
		3. Nedumudi
		4. Muttar
		5. Ramankari
		6. Kainakari
		7. Pulinkunnu
		8. Kavalam
		9. Veliyanad
		10. Neelamperoor

(1)	(2)	(3)
		11. Kozhimukku 12. Champakkulam
Kartika-ppally	Kartika-ppally	1. Thrikkunnapuzha 2. Karuvatta 3. Cheruthana 4. Veeyapuram 5. Harippad 6. Kumarapuram 7. Kartikappally 8. Pallippad 9. Chingoli 10. Arattupuzha 11. Muthukulom 12. Cheppad 13. Pathiyoor 14. Keerikkad 15. Kandalloor 16. Puthuppalli 17. Kayamkulam
Chenga-nnoor	Chenga-nnoor	1. Kurattissery 2. Mannar 3. Chengannoor 4. Pandanad 5. Thiruvanvandoor 6. Mulakuzha 7. Puliyoor 8. Cherianad 9. Ala 10. Venmony 11. Vadakkekara (portion) 12. Aranmula 13. Mezhuveli 14. Kulanada
Maveli-kkara	Maveli-kkara	1. Vallikkunnom 2. Bharanikkavu 3. Peringala

(1)	(2)	(3)	
		4. Kannamangalam	
		5. Thripperunthura	
		6. Chennithala	
		7. Mavelikkara	
		8. Thekkekara	
		9. Chazhakkara	
		10. Palamel	
		11. Noornaad	
		12. Chunakkara	
		13. Thamarakkulam	
		Total : 6	72

PATHANAMTHITTA

(1)	(2)	(3)
Adoor	Adoor	1. Koodal
		2. Enadimangalam
		3. Kodumon
		4. Angadical
		5. Adoor
		6. Ezhamkulam
		7. Erath
		8. Peringanadu
		9. Kadambanadu
		10. Pandalam Thekkekara
		11. Thonnallur
Kozhen-cherry	Pathanam-thitta	1. Pathanamthitta
		2. Naranganam
		3. Mallapuzhassery
		4. Elanthoor
		5. Chenneerkara
		6. Omallur
		7. Malayalapuzha
		8. Thannithode
		9. Konnithazham
		10. Iravan
		11. Konni

(1)	(2)	(3)
		12. Pramadom
		13. Vallikode
		14. Aranmula
		15. Kidangannur
		16. Mezhuveli
		17. Kulanada
Thiruvalla	Thiruvalla	1. Kizhakkumbhagom
		2. Kadapra
		3. Nedumpuram
		4. Peringara
		5. Thiruvalla
		6. Kavumbhagom
		7. Iraviperoor
		8. Thottapuzhassery
		9. Koipuram
Mallappally	Mallappally	1. Kallooppara
		2. Mallappally
		3. Anikkadu
		4. Kottangal
		5. Perumpetty
		6. Ezhumattoor
		7. Kaviyoor
		8. Puramattom
Ranny	Ranny	1. Angadi
		2. Pazhavangadi
		3. Chethakkal
		4. Perunad
		5. Vadasserikkara
		6. Chittar-Seethathode
		7. Ranny
		8. Cherukole
		9. Ayiroor
Total : 5		54

IDUKKI

(1)	(2)	(3)
Peermedu	Peermedu	1. Peermedu
		2. Manchumala
		3. Periyar
		4. Kumily
		5. Mlappara
		6. Peruvanthanam
		7. Kakkayar
		8. Vagamon
		9. Elappara
		10. Upputhara
		11. Pasuppara
Udumban-chola	Udumban-chola	1. Chinnakkanal
		2. Rajkad
		3. Santhanpara
		4. Konnathady
		5. Vathikudy
		6. Udumbanchola
		7. Thankamony
		8. Chathurangapara
		9. Kalkoonthal
		10. Parathodu
		11. Vandanmedu
		12. Chakkupalam
		13. Karunapuram
		14. Pampadumpara
		15. Kattappana
		16. Ayyappancoil
Thodupuzha	Thodu-puzha	1. Thodupuzha
		2. Karikodu
		3. Alacodu
		4. Muttom
		5. Manakad

(1)	(2)	(3)
		6. Karimkunnam
		7. Purapuzha
		8. Kumaramangalam
		9. Karimannoor
		10. Udumbannoor
		11. Kodikulam
		12. Kudayathur
		13. Arakulam
		14. Velliyamattom
		15. Idukki
Devikulam	Devikulam	1. K. D. H. Village
		2. Marayoor
		3. Kanthalloor
		4. Keezhanthoor
		5. Vattavada
		6. Kottakampoor
		7. Pallicasal
		8. Vellathooval
		9. Mannamkadom
		10. Kuttampuzha
TOTAL : 4		52

KOTTAYAM

Kottayam	Kottayam	1. Kottayam
		2. Vijayapuram
		3. Thiruvarppu
		4. Kumarakom
		5. Ettumanoor
		6. Athirampuzha
		7. Kaipuzha
		8. Onamthuruth
		9. Perumbaikadu
		10. Aymanam

(1)	(2)	(3)
		11. Puthuppally
		12. Nattakam
		13. Manarcadu
		14. Pampady
		15. Panachikad
		16. Anicadu
		17. Kooroppada
		18. Akalakunnam
		19. Ayarkunnam
Kanjirap-pally	Kanjirap-pally	1. Kanjirappally
		2. Mundakayam
		3. Chirakadavu
		4. Elikulam
		5. Erumely North
		6. Erumelu South
		7. Manimala
		8. Cheruvally
Meenachil	Meenachil	1. Kadanad
		2. Vallichira
		3. Puliyannoor
		4. Lalam
		5. Poovarany
		6. Meenachil
		7. Bharananganam
		8. Uzhavoor
		9. Veliyannoor
		10. Ramapuram
		11. Vellilappally
		12. Kurichithanam
		13. Kuravilangad
		14. Kanakkari
		15. Elackad
		16. Kidangoor
		17. Melukavu
		18. Thalappalam
		19. Kondoor
		20. Poonjar Vadakkekara

(1)	(2)	(3)
		21. Poonjar Nadubhagam
		22. Poonjar Thekkakara
Changana-cherry	Changana-cherry	1. Changanacherry
		1. Changanacherry
		2. Vazhappally East
		3. Vazhappally West
		4. Kurichy
		5. Thrikodithanam
		6. Madappally
		7. Vakathanam
		8. Karukachal
		9. Nadumkunnam
		10. Kangazha
		11. Vellavoor
		12. Vazhoor
Vaikom	Vaikom	1. Chempu
		2. Velloor
		3. Vadayar
		4. Kulasekharamangalam
		5. Vadakkemuri
		6. Naduvile
		7. Vaikom
		8. Thalayazham
		9. Vechoor
		10. Kallara
		11. Kanjoor
		12. Kaduthuruthy
		13. Njeezhoor
Total : 5		*74*

ERNAKULAM

(1)	(2)	(3)
Alwaye	Alwaye	1. Alwaye East & West
		2. Chengamanad

(1)	(2)	(3)
		3. Parakkadavu
		4. Kothakulangara North
		5. Kothakulangara South
		6. Manickamangalam
		7. Manjapra
		8. Malayattoor
		9. Chowara
		10. Thekkumbhagam
		11. Vadakkumbhagam
		12. Kizhakkumbhagam
Cochin	Cochin	1. Kumbalanghy
		2. Chellanam
		3. Rameswaram
		4. Palluruthy
		5. Mattancherry
		6. Fort Cochin
		7. Palliport
		8. Elamkunnapuzha
		9. Nayarambalam
		10. Narakkal
		11. Edavanakkad
		12. Kuzhuppilly
Parur	Parur	1. Parur
		2. Ezhikkara
		3. Kottuvally
		4. Chennamangalam
		5. Puthenvelikkara
		6. Alroor
		7. Vadekkekara
		8. Varapuzha
		9. Alengad
		10. Kadungalloor
Kanayannur	Kanayannur	1. Poonithura

(1)	(2)	(3)
		2. Edakkattuvayal
		3. Kalppattoor
		4. Thiruvankulam
		5. Edappally South
		6. Edappally North
		7. Kanayannur
		8. Kureckad
		9. Nadama
		10. Thekkumbhagam
		11. Thrikkakara North
		12. Thrikkakara South
		13. Kadamakkudy
		14. Ernakulam
		15. Maradu
		16. Elamkulam
		17. Mulavukad
		18. Manakunnam
		19. Cheranellur
		20. Amballur
		21. Kulayettikara
		22. Keecheri
		23. Kumbalam
		24. Mulamthuruthy
Kothamangalam.	Kothamangalam	1. Kadavoor
		2. Pothanicad
		3. Kothamangalam
		4. Kuttamangalam
		5. Keerampara
		6. Kottappady
		7. Pindimana
		8. Varappetty
Muvattupuzha	Muvattupuzha	1. Velloorkunnam
		2. Muvattupuzha
		3. Memuri
		4. Piravom
		5. Maneed

1	(2)	(3)
		6. Onakkur
		7. Manjallur
		8. Mulavoor
		9. Ramamangalam
		10. Thirumarady
		11. Valakam
		12. Palakuzha
		13. Enanallur
		14. Elanji
		15. Arakuzha
		16. Marady
		17. Koothattukulam
		18. Kalloorkad
Kunnathunad	Perumbavoor	1. Perumbavoor
		2. Cheranelloor
		3. Vengoor East
		4. Vengoor West
		5. Asamannur
		6. Vengola
		7. Vazhakulam Sirkar
		8. Vazhakulam Edavagai
		9. Kunnathunad
		10. Chemmanad
		11. Kizhakkambalam
		12. Mazhuvannoor
		13. Aikkaranad North
		14. Aikkaranad South
		15. Vadavucod
		16. Rayamangalam
Total 7		100

(1)	(2)	(3)
	TRICHUR	
Trichur	Trichur	1. Kaiparamba
		2. Anjur
		3. Avanur
		4. Thangaloor
		5. Velappaya
		6. Killannur
		7. Kurichikkara
		8. Kolazhy
		9. Pattore
		10. Choolissery
		11. Peramangalam
		12. Edakkalathur
		13. Tholur
		14. Chittilappilly
		15. Chalakkal
		16. Adat
		17. Puranattukara
		18. Puzhakkal
		19. Kuttoor
		20. Ponkunnam
		21. Trichur
		22. Peringavu
		23. Nettissery
		24. Vellanikkara
		25. Madakkathara
		26. Pananchery
		27. Mulayam
		28. Mannamangalam
		29. Puthur
		30. Kainoor
		31. Kozhukkully
		32. Parakkad
		33. Eravu
		34. Manalur
		35. Karamuck

(1)	(2)	(3)
		36. Padiyam
		37. Anthicad
		38. Pullu
		39. Veluthur
		40. Manakkody
		41. Kodannur
		42. Venginissery
		43. Palissery
		44. Vallachira
		45. Arattupuzha
		46. Oorakam
		47. Cherpu
		48. Paralam
		49. Pallippuram
		50. Alappad
		51. Chazhoor
		52. Kizhakkummuri
		53. Vadakkummuri
		54. Thanniyam
		55. Kurumpilavu
		56. Inchamudi
		57. Kizhuppillikkara
Talappilly	Talappilly	1. Kattakampal
		2. Pazhanji
		3. Kadavallur
		4. Karikkad
		5. Perumpilavu
		6. Kadangode
		7. Trichur
		8. Pilakkad
		9. Arangottukara
		10. Thalassery
		11. Pallur
		12. Desamangalam
		13. Varavoor
		14. Nedumpura

(1)	(2)	(3)
		15. Cheruthuruthy
		16. Panjal
		17. Killimangalam
		18. Painkulam
		19. Venganellur
		20. Mayannur
		21. Kondazhy
		22. Paniyarkode
		23. Pampady
		24. Thiruvilwamala
		25. Vadakkethara
		26. Chelakkode
		27. Pulakkode
		28. Pazhayannur
		29. Vennur
		30. Elanad
		31. Pangarappilly
		32. Chelakkara
		33. Kurumala
		34. Thonnurkara
		35. Attur
		36. Mullurkkara
		37. Kumaranellur
		38. Kanjirakkode
		39. Chittanda
		40. Kottappuram
		41. Nelluvaye
		42. Kariyannur
		43. Vellarakkad
		44. Chiramanangad
		45. Akathiyoor
		46. Porkolam
		47. Mangad
		48. Anjur (Portion)
		49. Kunnamkulam (Portion)
		50. Chowannur (Portion)

		51. Eyyal
		52. Vellattanjur
		53. Thayyur
		54. Puthuruthy
		55. Wadakkancherry
		56. Emkakkad
		57. Karumathara
		58. Viruppakka
		59. Manalithara
		60. Thekkumkara
		61. Parlikad
		62. Minalur
		63. Peringadoor
		64. Mundathikode
		65. Kiralur
		66. Vellur
		67. Chiranellur
		68. Chemmanthata
		69. Kanipayyur (Portion)
		70. Arthat
		71. Kandanissery
		72. Alur
		73. Choondal
		74. Eranellur
Mukundapuram	Mukundapuram	1. Kattur
		2. Karalam (Portion)
		3. Porathisseri (Portion)
		4. Madayikkonam
		5. Thottippal
		6. Parappukara
		7. Nenmenikkara
		8. Trikkur
		9. Kallur
		10. Amballur
		11. Varandarappilly

12. Mupliyam
13. Mattathur
14. Nandipulam
15. Chengallur
16. Nellayi
17. Anandapuram
18. Muriyad
19. Pullur (Portion)
20. Irinjalakuda (Portion)
21. Manavalassery (Portion)
22. Edathirinji
23. Padiyur
24. Poomangalam
25. Vellookkara
26. Kaduppassery
27. Kallettumkara
28. Kodakara
29. Kodassery
30. Pariyaram
31. Elinjipra
32. Alur
33. Thazheddad
33. Thazhekkad
34. Kottanellur
35. Vadakkumkara
36. Thekkumkara
37. Vallivattom
38. Karumathra
39. Puthenchira
40. Vadama
41. Vadakkumbhagam
42. Annallur
43. Muringur Vadakkummuri
44. Melur
45. Kizhakkummuri
46. Muringur Thekkummuri

(1)	(2)	(3)
		47. Kallur Vadakkummuri
		48. Kallur Thekkummuri
		49. Alathur
		50. Kurivilassery
		51. Kakkulassery
		52. Thirumukkulam
Chavakkad	Chavakkad	1. Punnayurkkulam
		2. Punnayur
		3. Vadakkekad
		4. Pookode
		5. Chavakkad (Portion)
		6. Orumanayur
		7. Pavaratty
		8. Elavally
		9. Mullassery
		10. Venkitangu
		11. Engandiyur
		12. Vadanappilly
		13. Thalikkulam
		14. Nattika
		15. Valappad
Kodungalloor	Kodungalloor	1. Edathiruthy
		2. Chendrappini
		3. Kaipamangalam
		4. Perinjanam
		5. Koolimuttam
		6. Pappinivattom
		7. Padinjare Vemballur
		8. Panagad

		9. Ala
		10. Edavilangu
		11. Eriyad
		12. Azhikode
		13. Pallippuram
		14. Poyya
		15. Madathumpady
TOTAL 5		213

MALAPPURAM

Tirur	Malappuram	1. Purathur
		2. Mangalam
		3. Triprangode
		4. Vettam
		5. Ananthavour
		6. Tirinavaya
		7. Thalakkad
		8. Tirur
Ernad	Ernad	1. Arecode
		2. Kavanur
		3. Narukara
		4. Pulpatta
		5. Edavanna
		6. Parakamanna
		7. Thrikalangode
		8. Vettikkattiri
		9. Payyanad
		10. Manjeri
		11. Elankur
		12. Tiruvali
		13. Narukara

1	2	3
Perinthalmanna	Perinthalmanna	1. Edappatta
		2. Melattur
		3. Vettathur
		4. Alipparamba
		5. Anamangad
		6. Elamkulam
		7. Arakkuparamba
		8. Thazhekkpde
		9. Perinthalmanna
		10. Pathayikkara
		11. Nenmini
		12. Keezhattur
		13. Kavriavattam
Ponnani	Ponnani	1. Ponnani
		2. Ezhuvarhieurhy
		3. Tavanur
		4. Kaladi
		5. Edappal
		6. Vattamkulam
		7. Maranchery
		8. Perumpadappu
		9. Veliancode
		10. Nannammukku
		11. alancode
TOTAL :		45

KOZHIKODE

Badagara	Badagara	1. Kuttiadi
		2. Kavilumpara

(1)	(2)	(3)
		3. Maruthomkara
		4. Azhiyur
		5. Onchiyam
		6. Eramala
		7. Villiappally
		8. Ayanchery
		9. Kottappally
		10. Thiruvallur
		11. Purameri
		12. Nadapuram
		13. Thuneri
		14. Edacherry
		15. Palayad
		16. Maniyur
		17. Chekkiyad
		18. Valayam
		19. Vanimal
		20. Kunnummal
		21. Naripatta
		22. Kayakkodi
		23. Chorode
		24. Badagara
		25. Nadakkuthazha
Quilandy	Quilandy	1. Chemanchery
		2. Chengottukavu
		3. Panthalayini
		4. Viyyur
		5. Moodadi
		6. Thikkodi
		7. Payyoli
		8. Thurayur
		9. Kozhukkallur

(1)	(2)	(3)
		10. Meppayur
		11. Cheruvannur
		12. Arikkulam
		13. Keezhariyur
		14. Velam
		15. Paleri
		16. Changaroth
		17. Koothali
		18. Perambra
		19. Pannikottur
		20. Peruvanna
		21. Eravattur
		22. Menhaniam
		23. Nochad
		24. Naduvannur
		25. Kottur
		26. Avitanallur
		27. Kayanna
		28. Kanthalad
		29. Unnikulam
		30. Sivapuram
		31. Kinalur
		32. Panagad
		33. Balussery
		34. Ulliyeri
		35. Atholi
Kozhikode	Kozhikode	1. Nagaram
		2. Kasba
		3. Pannlankara
		4. Beypore
		5. Cheruvannur
		6. Feroke
		7. Ramanattukara
		8. Kadalundy
		9. Katcheri
		10. Thalakkulathur
		11. Chevayur

1	2	3
		12. Elathur
		13. Vengeri
		14. Chelavoor
		15. Chelannur
		16. Nellikkode
		17. Olavanna
		18. Kakkodi
		19. Perumanna
		20. Koduvally
		21. Kizhakkoth
		22. Koodathai
		23. Thiruvambady
		24. Narikuni
		25. Kuruvatoor
		26. Kakkur
		27. Nanminda
		28. Madavoor
		29. Kedavoor
		30. Raroth
		31. Kodiyathur
		32. Kunnamangalam
		33. Chathamangalam
		34. Neeleswaram
		35. Mavoor
		36. Peruvayal
		37. Poolacode
		38. Kakkad
		39. Thazhekode
		40. Kumaranallur
		41. Kodenchery
		42. Puthupadi
		43. Outhur
TOTAL : 3		103

(1)	(2)	(3)
	PALGHAT	
Ottappalam	Ottappalam	1. Ottappalam I
		2. Ottappalm II
		3. Ambalapara I
		4. Ambalapara II
		5. Lakkidi Perur I
		6. Lakkidi Perur II
		7. Shoranur I
		8. Shoranur II
		9. Vaniamkulam I
		10. Vaniamkulam II
		11. Ananganadi
		12. Chalavara
		13. Pattambi
		14. Nellaya
		15. Kulukkallur
		16. Vallapuzha
		17. Vilayur
		18. Muthuthala
		19. Parudur
		20. Koppam
		21. Ongallur I
		22. Ongallur II
		23. Thiruvegappura
		24. Sreekrishna-purma I
		25. Sreekrishna-puram II
		26. Trikkadeeri I
		27. Trikkadeeri II
		28. KatampazhipuramI
		29. Katampazhi-puram II
		30. Karimpuzha I
		31. Karimpuzha II
		32. Vellinezhy

(1)	(2)	(3)
		33. Cherpalacherry
		34. Trithala
		35. Pattithara
		36. Thirumittacode I
		37. Thirumittacode II
		38. Chalissery
		39. Nagalassery
		40. Kappur
		41. Anakkara
Mannarghat	Mannarghat	1. Ananallur I
		2. Ananallur II
		3. Ananallur III
		4. Thachanattukara
		5. Chethallur
		6. Kottoppadam I
		7. Kottoppadom II
		8. Kottoppadam III
		9. Kumaramputhur
		10. Mannarghat I
		11. Mannarghat II
		12. Pottessery I
		13. Pottassery II
		14. Karimba I
		15. Karakurussi
		16. Agali
		17. Pudur
		18. Sholayur
Palghat	Palghat	1. Palghat I
		2. Palghat II
		3. Palghat III
		4. Malampuzha I
		5. Malampuzha II

(1)	(2)	(3)
		6. Marutharode
		7. Kannadi II
		8. Kannadi II
		9. Pirayiri
		10. Akathethara
		11. Parli I
		12. Parli II
		13. Mankara
		14. Mannur
		15. Keralassery
		16. Kongad I
		17. kongad II
		18. Mundur I
		19. Mundur II
		20. Pudupariyaram I
		21. Pudupariyaram II
		22. Elappully I
		23. elappullt II
		24. Pudussery East
		25. Pudussery Central
		26. Pudussery West
		27. Kodumba
		28. Polpully
		29. Peruvemba
Alathur	Alathur	1. Alathur
		2. Erimayur I
		3. Erimayur II
		4. Melarcode
		5. Vandazhi I
		6. Vandazhi II
		7. Kizhakkencherry I
		8. Kizhakkencherry II
		9. Vadakkencherry I
		10. Vadakkencherry II
		11. Kannambra I
		12. Kannambra II

(1)	(2)	(3)
		13. Tarur I
		14. Tarur II
		15. Kavassery I
		16. Kavassery II
		17. Puducode
		18. Thenkurussi I
		19. Thenkurussi II
		20. Kuzhalmannam I
		21. Kuzhalmannam II
		22. Kuthannur I
		23. Kuthannur II
		24. Mathur I
		25. Mathur II
		26. Peringottukurussi I
		27. Peringottukurussi II
		28. Kottayi I
		29. Kottayi II
Chittur	Chittur	1. Kozhipathy
		2. Vadakarapathy
		3. Eruthempathy
		4. Ozhalapathy
		5. Vallavallampathy
		6. Kozhinjampara
		7. Thekkedesom
		8. Chittur
		9. Nallepully
		10. Tattamangalam
		11. Pattancherry
		12. Porumatty
		13. Moolathara
		14. Nemmara
		15. Vallenghy
		16. Ayalur
		17. Kayaradi
		18. Kollengode I
		19. Kollengode II
		20. Vadavannur

		21. Koduvayur I
		22. Koduvayur II
		23. Muthalamada I
		24. Muthalamada II
		25. Pallassana
		26. Elavancherry
TOTAL : 5		143

CANNANORE

Taliparamba	Taliparamba	1. Ramanthali
		2. Payyannur
		3. Vellur
		4. Karivellur
		5. Peralam
		6. Alappadamba
		7. Peringome
		8. Vayakkara
		9. Thadikkadavu
		10. Kuttur
		11. Eramam
		12. Kankole
		13. Korome
		14. Pariyaram
		15. Kooverim
		16. Naduvil
		17. Chuzhali
		18. Panniyur
		19. Kuttieri
		20. Pattuvam
		21. Morazha
		22. Andhur
		23. Kurumathur
		24. Chengalayi
		25. Nediyanga
		26. Sreekandapuram
		27. Malappattam
		28. Kayaralam

		29. Kolacheri
		30. Cheleri
		31. Maniyur
		32. Mayyil
		33. Kuttiattur
		34. Irikkur
		35. Kalliyad
		36. Padiyur
Cannanore	Cannanore	1. Madayi
		2. Kunhimangalam
		3. Cheruthazham
		4. Kadannappally
		5. Panappuzha
		6. Ezhome
		7. Cherukunnu
		8. Mattool
		9. Kannapuram
		10. Narath
		11. Kannadiparamba
		12. Valiyannur
		13. Munderi
		14. Anjarakandy
		15. Iriveri
		16. Mavilayi
Tellicherry	Tellicherry	1. Pathiriyad
		2. Paduvilayi
		3. Keezhallur
		4. Koodali
		5. Kolari
		6. Chavasseri
		7. Keezhur
		8. Payam
		9. Aralam
		10. Muzhakkunnu
		11. Thillenkeri
		12. Sivapuram
		13. Kandamkunnu
		14. Pazhassi
		15. Mangattidam

(1)	(2)	(3)
		16. Eruvatti
		17. Kadirur
		18. Panniyannur
		19. Mokeri
		20. Pattiom
		21. Mananthen
		22. Kannavam
		23. Kolayad
		24. Vekkalam
		25. Tholambra
		26. Vellarvalli
		27. Manathana
		28. Kappad
		29. Cheruvancheri
		30. Kolavallur
		31. Puthur
		32. Panoor
		33. Trippangottur
		34. Peringathur
		35. Chokli
TOTAL : 3		87

WYNAD

(1)	(2)	(3)
Manathody	Mananthody	1. Peria
		2. Thondernad
		3. Vellamunda
		4. Porunnanoor
		5. Anchukunnu
		6. Kuppathodu
		7. Nallurnad
		8. Edavaka
		9. Thavinjal
		10. Vemom
		11. Thirunelli

(1)	(2)	(3)
Vythiri	Vythiri	1. Padinjarethara
		2. Kooppadithara
		3. Kottathara
		4. Thariyode
		5. Achuranam
		6. Vengappalli
		7. Kalpetta
		8. Kunnathidavaka
		9. Kottappadi
		10. Muppayinad
		11. Muttil
		12. Kaniyampatta
Sultan Battery	Kalpetta	1. Ambalavayal
		2. Purakkadi
		3. Poothadi
		4. Pulppalli
		5. Kidanganad
		6. Sultan Battery
		7. Noolpuzha
		8. Nenmeni
TOTAL : 3		31

KASARAGOD

Kasaragod	Kasaragod	1. Kunjathur
		2. Kosbettu
		3. Vorkady
		4. Kodlamaogru
		5. Meenja
		6. Kadambar
		7. Uppala
		8. Ichlangod

(1)	(2)	(3)
		9. Kayyar
		10. Paivalika
		11. Bayar
		12. Bombrana
		13. Koipady
		14. Edanad
		15. Badoor
		16. Marie
		17. Enmakaje
		18. Padre
		19. Nettainige
		20. Kumbadje
		21. Perdala
		22. Bela
		23. Madhur
		24. Kudlu
		25. Kasaragod
		26. Chengala
		27. Padi
		28. Muliyar
		29. Adhur
		30. Adoor
		31. Delemapady
		32. Bandadka
		33. Kuttikode
		34. Bedadkha
		35. Kolathur
		36. Thekkil
		37. Kalnad
Kasaragod	Hosdurg	1. Hosdurg
		2. Kanhangad
		3. Chittari
		4. Anjanur
		5. Madikai

(1)	(2)	(3)
		6. Pallikkara
		7. Udma
		8. Panathady
		9. Meloth
		10. Beloor
		11. Pullur
		12. Periya
		13. Panayal
		14. Kallar
		15. Neleswar
		16. Cheruvathur
		17. Pilicode
		18. Kodakkad
		19. Padna Udinoor
		20. North Trikerpur
		21. South Trikarpur
		22. Kinanur
		23. Karindalam
		24. Kayyur
		25. Cheemani
		26. East Eleri
		27. West Eleri
TOTAL: 2		64

GRAND TOTAL (STATE) 61 — 1268

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ERRATA

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5	7	catastrophy	catastrophe
50	31	....	insert stream
56	18	steams	streams
57	32	Cherra Kuzhi	Cheera Kuzhi
96	34	every	even
97	27	posible	possible
98	6	torrentall	torrential
98	35	wter	water
99	28	Ground water	water
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295	29	southermost	southernmost
296	3	cloudness	cloudiness

State Tree — Coconut Tree (Cocos Nucifera)

State Animal – Elephant (Elephas Maximus)

State Bird — The Great Indian Hornbill (Buceros Bicornis)

Kerala — a general view